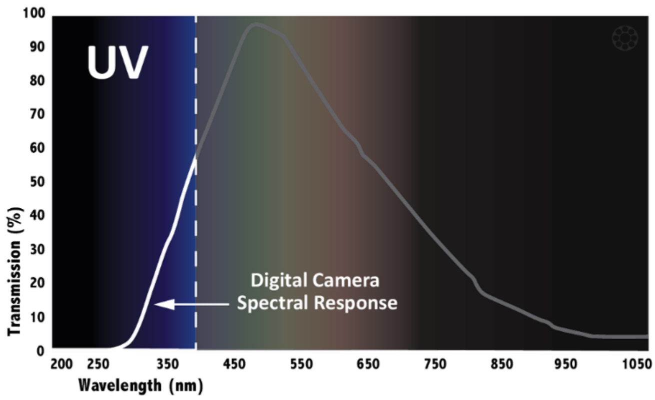
ULTRAVIOLET IMAGING



When it comes to ultraviolet (UV) imaging, it's important to distinguish between UV light and UV-fluorescence imaging. Although they both use UV lighting, they're entirely different. UV imaging starts with passing the emission of a UV-emitting LED, lamp or diode, or looking at a subject illuminated with UV light that's reflected off the item being inspected. The reflected UV light is then captured by the camera. The wavelength of the UV light is not converted or shifted in this process.

In contrast, UV-fluorescence imaging also requires illuminating a surface with UV light, but the fluorescent material absorbs the UV light and electrons are released, causing the material to radiate light at a longer wavelength. The light emitted during this process is usually in the visible range and, in industrial applications, it will usually be blue light. In this type of reaction, light energy in will always exceed light energy out.

True ultraviolet (UV) imaging inspection isn't used often in machine vision. However, as UV-sensitive cameras and UV-emitting light sources, particularly LED lighting, have become widely available and less costly, new applications are emerging. Monochromatic UV sources, such as lasers and LEDs, are desirable in machine vision applications because when paired with appropriate Bandpass Filters, camera optics don't need to be achromatic, significantly lowering cost.

Images formed with monochromatic illumination are always sharper than images made with broader UV sources, and capability naturally increases as the wavelength used to image the item being inspected is shortened. When using UV illumination, smaller features can often be formed and detected easier and more accurately. This is why monochromatic UV (excimer) lasers and optical imaging are used in producing almost all integrated circuits today.

The UV band is broad, spanning a wavelength range from 10 nm (below this are x-ray wavelengths) to 400 nm (above this are visible wavelengths). A system's cameras, optics, filtering and illumination must be carefully selected according to the UV range being imaged. Otherwise, because of internal camera filtering and the optical lenses being used, most visibly-optimized charge-coupled device (CCD) and complimentary metal oxide semiconductor (CCD) cameras and lens systems will block all of the deep-UV and most of the near-UV spectrum.

The near-UV, between 290 and 400 nm, is most commonly used in industrial imaging applications. This range is typically subdivided into UV-A (320 to 400 nm) and UV-B (290 to 320 nm) radiation. Standard optical glasses absorb light and cannot be used for imaging in the region below 290 nm, known as the UV-C or deep-UV (DUV) portion of the spectrum. Instead, lenses incorporating fused silica, fused quartz or calcium fluoride are designed for these applications. Below 180 to 190 nm air absorbs UV light. This UV portion is often referred to as the vacuum UV (VUV), since imaging can only take place in a very high vacuum or nitrogen environment.

Because UV wavelengths are shorter and easily scattered, some of the most common applications for true UV imaging include detecting scratches and digs on polished or highly specular surfaces. By using darkfield illumination to enhance the scattering effect, scratches that aren't apparent in a visible image can become easier to image in UV. UV photolithography processes are used in the production of computer chips. Patterns are optically imaged onto a silicon wafer that's covered with a film of UV light-sensitive material (photoresist). The photoresist is then further processed to create the actual electronic circuits on the silicon.

Other applications involving reflected UV light include detecting surface contamination. Since UV light tends to be absorbed by organic materials, traces of oil or grease can sometimes be detected on surfaces, particularly in the deep-UV. Petroleum-based products can also appear differently in the UV, which can be useful in identifying the nature and source of oil spills. It's also sometimes possible under UV illumination to distinguish different paints or finishes used if repairs have been made to antiques or other valuable objects.

Part #	Description	*Useful Range*	FWHM
BP250	Deep-to-Near-UV Bandpass Filter	*230-280nm*	*40nm*
BP324	Near-UV Bandpass Filter	*290-365nm*	*105nm*
BP365	Near-UV Bandpass Filter	*335-400nm*	*80nm*

Please feel free to contact us for additional information at inquiry@vlt.nl
or contact us at +31 413 260067

Vision Light Tech B.V.
Protonenlaan 22, 5405 NE UDEN, P.O. Box 345, 5400 AH UDEN, The Netherlands
Phone: +31 (0)413 26 00 67, Fax +31 (0)413 26 09 38, E-mail: inquiry@vlt.nl, Website: www.vlt.nl
Trade register No. 17150044, VAT No. NL8112.30.946.B01