WAVELENGTH OPTO-ELECTRONIC

Infra® – SWIR Lens

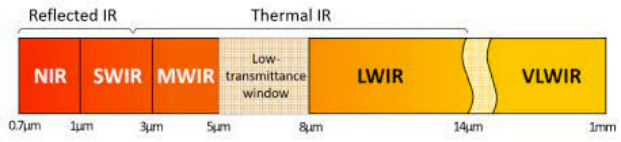
Introduction

Short-wave infrared (SWIR) light is a section of the electro-magnetic spectrum typically in the 0.9µm to 2.5µm (900nm to 2500nm) wavelength range and is therefore invisible to the human eye.

However SWIR light interacts with objects in a similar manner to visible wavelengths in that photons are reflected by the object itself. As a result of this reflective nature, SWIR light has contrast and shadows in the images it produces which are a necessary requirement for high resolution imaging.

SWIR is unlike Mid-Wave Infrared (MWIR) and Long-Wave Infrared (LWIR) light, which is emitted from an object as thermal IR (heat) and therefore has lower resolution and shows less detailed images.

SWIR wavelengths can only be seen by sensors such as Indium Gallium Arsenide (InGaAs). Images from inGaAs camera sensors are comparable in detail and resolution to visible light images but are not in colour. This is one of the many advantages of SWIR as it allows objects to be more easily recognised and individually identified.



Electro-magnetic Spectrum showing the SWIR Wavelength Range

Operation Principle

To achieve these high resolution images it is therefore essential to use a lens that is specifically designed and coated for the SWIR wavelength range.

Using a lens designed for the visible spectrum will result in lower resolution images and higher optical aberrations. Since SWIR wavelengths are transmissible through glass, then lenses, and other optical components (optical filters, windows etc.) designed for SWIR can be manufactured using the same techniques used for visible components. This leads to lower manufacturing costs and enables the use of protective windows and filters within the optical system.

Applications

A large number of applications that are difficult or impossible to perform using visible light are possible using SWIR. For example monitoring of the water content within agricultural products is a key aspect in measuring the maturity and health of the produce. Using a SWIR camera, crops can be inspected and examined for quality. As water is opaque and appears darker under SWIR lighting, this allows the camera to detect the moisture content of the product. Areas with higher water content will appear darker in comparison to the drier sections. These images show bruising below the surface of the skin of an apple that is undetectable by eye, but can be seen using SWIR.

Conclusion

At Wavelength Opto-Electronic we have developed the Infra® range of SWIR lenses to meet the latest advancements of SWIR technology. Our designs are for high resolution operation at low light levels. The Infra® range also offers a superior image quality with greater transmission and performance. Our Infra® SWIR lenses function in the wavelength ranges of 0.9µm to 2.5µm and 1.5µm to 5µm with sensor pixel sizes of 15, 17 and 30µm.

Mounted on an appropriate SWIR camera (C-mount or Bayonet), the manual focus Infra® range of lenses from Wavelength Opto-Electronic are the perfect choice for a wide variety of applications.

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