

PHOTONICS spectra

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High Performance SWIR Imaging Cameras

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Introduction to SWIR Imaging

Silicon based area detectors (e.g. CCDs or CMOS) are widely used in high performance imaging applications, detecting wavelengths from soft x-ray through to near infrared (NIR). Typically, the quantum efficiency (QE) of these detectors decreases rapidly as the detection wavelength increases further into the NIR region. Above 1100nm, Silicon is transparent and therefore cannot be used to directly detect photons of these wavelengths, however many other materials do have photon sensitivity at wavelengths of 1µm and longer. The definition for each 'sub-region' within VIS-IR wavelength range is outlined in Figure 1, along with some commonly used detector materials and their typical detection ranges. Each of the materials highlighted below present their own advantages and challenges and therefore prior to detector selection, the user must consider all aspects of the intended application, in addition to the wavelength response.

Many everyday objects appear markedly different when viewed in different wavelength bands, as illustrated in Figure 2, showing images of a bank note recorded at two different wavelengths. The image recorded at 550nm shows the printed images we see with our eyes, which enable us to determine that the object is a banknote as well as additional details such as the monetary value, the name of the bank which produced it and the location depicted on it. In the 1600nm image there are many different attributes clearly visible, including the creases in the note itself and some features from the other side of the note, such as the serial number near the bottom left corner, and a foil emblem just above it. However, in the absence of the more familiar visible wavelength features we might struggle to determine exactly what object was being imaged, if presented with the SWIR-only image alone. This very basic example highlights the power of SWIR imaging to uncover additional features of an object, but also illustrates how important a sensor which responds also to visible light can be for providing context to images in certain applications.



Figure 1: The various sub-regions of the electromagnetic spectrum, covering visible through to infrared wavelengths. Some common detector materials and their typical wavelength detection ranges are also listed.

White Paper

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