Fraunhofer IPM

SWIR camera

Imaging beyond the visible spectral range

Based on a SWIR camera, we develop inspection systems that are suitable for industrial use and make hidden material defects or invisible substances visible.

Revealing hidden defects

There are many optical contrasts the human eye cannot perceive and that cannot be depicted by conventional cameras either. Infrared imaging with short-wave light (SWIR – shortwave infrared) makes such contrasts visible. Fraunhofer IPM's SWIR camera produces high-contrast images of materials that are transparent in visible light and reveals internal structures in materials that are opaque to the human eye.

Invisible material contrasts

The human eye is excellent at detecting different colors and light intensities– but only in the visible wavelength band between approximately 400 and 800nm. Yet optical contrasts are not restricted to the visible spectral range. Substances frequently show contrast differences which are valuable for analytics in the shortwave infrared region between 900 and 1,700nm. SWIR cameras with InGaAs sensors are sensitive in this range, in contrast to the eye or conventional cameras. They can be used to examine workpieces and material compositions which do not show contrast for conventional cameras.

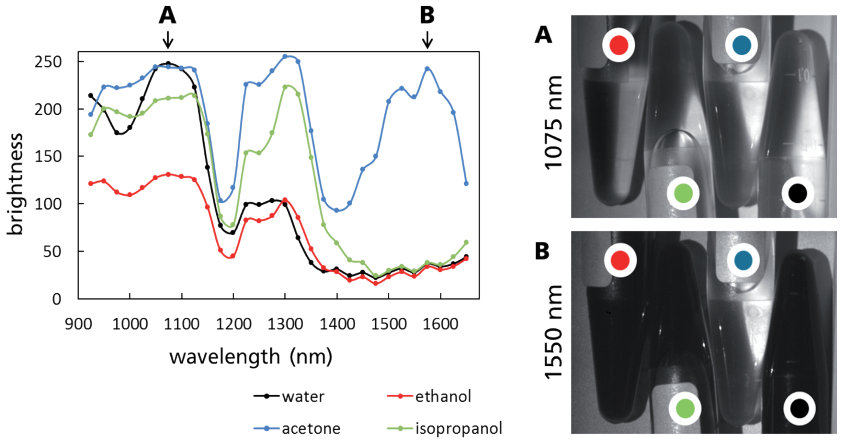
Unexpected material properties

The spectral dependence of absorption and scattering properties means that many non-transparent materials appear transparent to a SWIR camera. This applies to certain plastics and also to silicon. This infrared transparency of these materials can be utilized to make visible concealed elements, such as potted electronic circuitry. In silicon, even microscopic cracks become recognizable as distinct shadows. In addition, reduced light scatter in the infrared region allows process monitoring in environments containing steam or smoke, for instance.

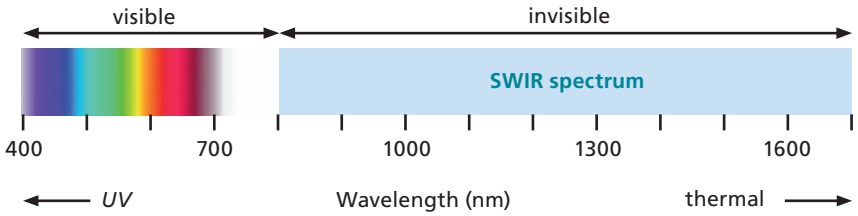
Our offer

From feasibility study to system integration

- Hyperspectral imaging of samples
- Customized system development
- Implementation at production site
- Automatedimage processing and analysis



Various solvents, which appear to have the same transparency to the human eye, have different absorption bands in the SWIR spectrum. This means that water, for instance, unlike acetone, appears black at 1,550 nm.



The SWIR ("shortwave infrared") spectrum is directly adjacent to the visible spectral range.

Conversely, many transparent substances, such as transparent plastics and solvents, show characteristic absorption bands in the infrared spectrum which make it possible to differentiate such materials. Water in particular shows strong absorption of light of around 1,500 nm. This property can be used, among other things, to measure moisture.

Other applications relate to examining security features such as security inks in the infrared spectrum. Thermographic measurements are equally possible: At temperatures of 100 °C and above, the SWIR camera can detect hidden material defects, for example in printed circuit boards.

Illumination characteristics

Individually designed LED illumination
Identification of suitable wavelength(s) by means of continuously tunable laboratory light source
Eye-safe design

Camera characteristics

Spectral range	900 – 1,700 nm
Sensor type	Thermoelectrically cooled InGaAs sensor
Standard resolution	640 × 512 pixels
Exposure times	Starting from 30 ms

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