Thermal measurement

Micro-Epsilon explains how to effectively optimize the measurement performance of infrared pyrometers and thermal imaging cameras typically used in the tire preparation area

Material temperature is one of the key characteristics to be considered in order to run an extrusion line efficiently. Micro-Epsilon is well known for its wide product range of inspection machines for the tire preparation area and measurement sensors. As noted by the company, there are many factors to consider when selecting a non-contact thermal measurement device. While emissivity and wavelength are crucial when measuring the temperature of specific materials or objects, other factors such as ease of setup, integration capabilities and compactness are equally important.

Thermal imaging cameras and infrared pyrometers measure the temperature of an object without touching it. This makes it possible to perform fast, reliable temperature measurements of moving objects or components that cannot be touched. Not only are these infrared measurement devices now relatively inexpensive, they also offer numerous features and options, including software tools to simplify integration for process control and high-speed recording for R&D environments. It is now also possible to select sensors and imagers that operate at specific wavelengths for particular materials, such as metals, ceramics and glass.

For accurate temperature measurement, users must carefully consider two key parameters: emissivity and wavelength.

All bodies above absolute zero (-273°C) emit infrared radiation in three ways, via a combination of emitted radiation, radiation reflected from the surroundings, and by transmitting the radiation through itself. How these factors interact depends on the material of the object to be measured. However, for non-contact infrared temperature measurements, only the emitted radiation element is important.

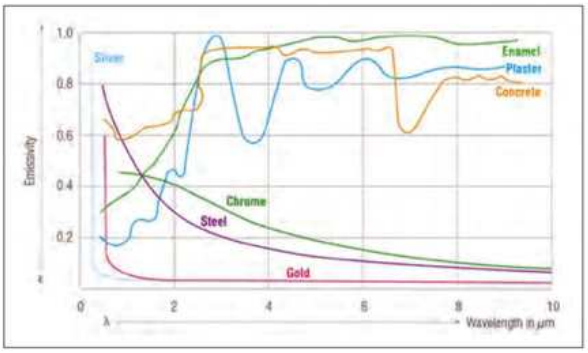
The relationship of the emission types to each other is best described in the following way. If, at any given temperature, the sum of the radiation of the three emission types is equal to one, and it is assumed that solid bodies transmit negligible radiation, the transmitted element can be treated as zero. Therefore, the heat energy coming from an object comprises only emitted and reflected radiation. This is why objects such as polished and shiny metals can have only a low emission, or emissivity, as radiation from the surrounding environment is strongly reflected (and so proportionally high) from these surfaces.

The emissivity of an object, however, will be greater or lower when monitoring the radiated heat energy at different wavelengths. Therefore, using IR cameras and pyrometers that measure temperature at specific wavelengths that match the high emissivity of specific materials can increase the measurement accuracy and stability.

Today, around 80% of IR cameras available on the market operate over the wavelength band of 8-14µm, which means these cameras are only giving accurate and stable measurement on objects with high emissivity in this wavelength band. These are generally objects with matt surfaces. Metal or shiny surfaces cannot be measured accurately using devices that operate at the 8-14µm wavelength band.

Above: Micro-Epsilon's infrared sensors are supplied in a compact package with integrated controller and various options including laser aiming and video interface

Below: The emissivity of metals and of non-metals



When selecting a suitable device, it is therefore vital that the wavelength band over which it measures is known and is best suited to the object to be measured. The object emissivity values over this wavelength and the temperature range to be measured must also be known or calculated. If the supplier doesn't have a specific wavelength camera or IR sensor for the material that needs to be measured, find one that does.

Micro-Epsilon has developed a complete range of IR cameras and temperature sensors for almost every conceivable target material. Specific wavelength sensors and cameras for measuring the temperature of hot metal surfaces or glass products (including very thin solar panel glass) and silicon, as well as devices for low temperature matt surfaces, are now available.

Thermal imagers and IR temperature sensors from Micro-Epsilon are fixed into position in a production process or R&D laboratory to monitor the temperature profile of target materials or objects. The cameras are designed for high-speed, high-accuracy measurements in process control, quality and R&D applications. In addition, license-free, fully featured software is supplied as standard. **tire**

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