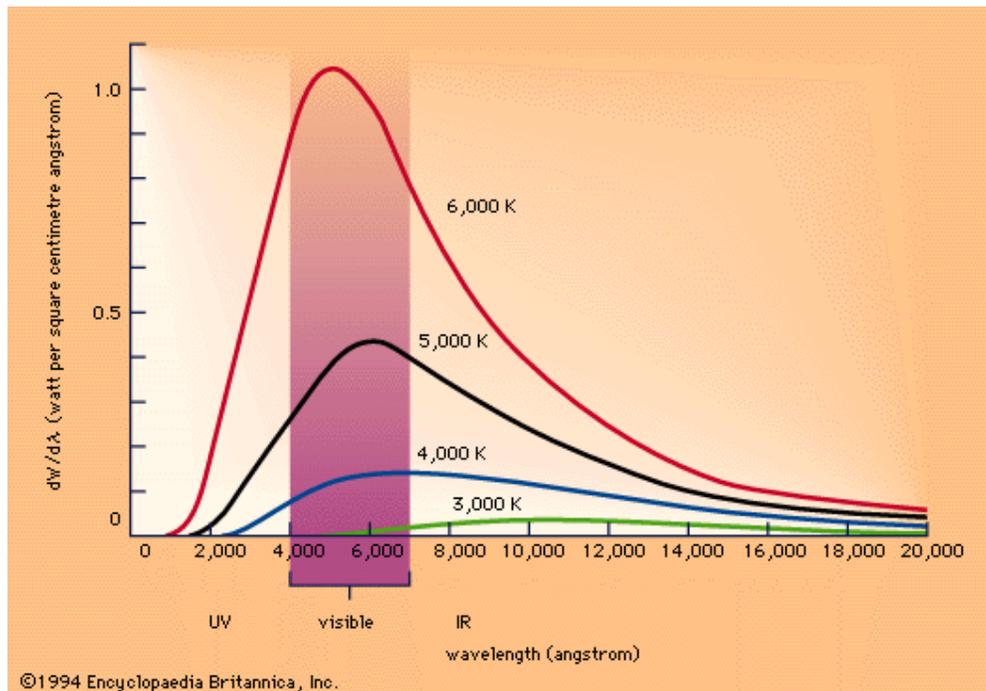


## Application Note: Thermal imaging in SWIR

### Key performance indicators:

- High temperature (>150°C) thermal imaging
- SWIR InGaAs sensors detect emitted radiation in the range 900 to 1700nm
- Metals at high temperature have large and fairly constant emissivity values in SWIR
- SWIR fills the gap between LWIR and visible (>700°C) thermal imaging
- Imaging through glass lenses and windows



*Planck curves: thermal emission of black bodies*

Thermal imaging is simply defined as the use of an infrared sensor to detect radiation emitted from an object in the SWIR, MWIR or LWIR region of the infrared spectrum. Any object higher in temperature than absolute zero will emit radiation. The amount of detectable radiation depends on the temperature and emissivity of the object, as well as the type of sensor used for imaging. In general, higher temperatures amount to more radiation and shorter peak wavelength emission.

SWIR cameras are useful tools for high temperature thermal imaging applications, where object temperatures are above 150°C. Some examples of these applications include industrial furnace monitoring, hot end glass bottle inspection, and detection of slag impurities in molten metal.

For most hot metal objects, having large emissivity values in SWIR range, slight variations in the emissivity lead only to minor changes of the resulting surface temperatures.

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***Furnace inspection***

SWIR cameras can be integrated into measurement systems for continuous monitoring of high temperature industrial furnaces. High temperature furnaces are used in a variety of industrial markets including petrochemical and pulp/paper processing. In order to keep furnace efficiency at a maximum and insure against catastrophic failures, it is important to monitor material build up and furnace temperature, as well as other application specific operating parameters.

***Detection of slag impurities in molten metal***

SWIR cameras have proven to be effective at detecting and monitoring slag impurities in molten metal because of the emissivity differences between the slag and metal at that temperature. This helps prevent unwanted impurities from contaminating the metal. Missing this process end point can affect steel quality and translates directly into higher cost of production for manufacturing facilities.

***Glass inspection***

Picking out defective glass products the hot end of the process, while the temperature is still above 200°C, is particularly interesting for glass manufacturers. At that stage, rejects are identified, then shunted aside and reprocessed efficiently, greatly reducing scrap. Unlike thermal cameras, short SWIR cameras can image through glass, allowing operators to inspect both the interior and exterior walls of the bottle, as well as monitor the temperature uniformity and cooling rate of the material.



Glass ceramic cooking plate imaged with XEVA InGaAs camera

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