

Fig. 1: State-of-the-art micro light bulb with a wire tungsten filament (left) and a metal-sheet filament (right) – supported by MGG MICRO-GLÜHLAMPEN-GESELLSCHAFT Menzel GmbH.

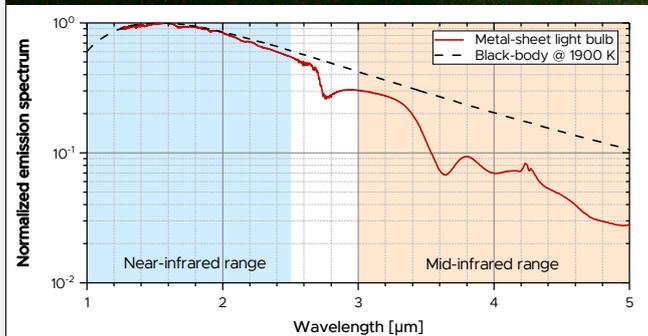


Fig. 2: Emission spectrum of a metal-sheet light bulb in the near-infrared and mid-infrared range.

The metal-sheet filament

Tungsten light bulbs – the broadband standard

The tungsten (halogen) lamp is commonly used as a light source for absorption spectroscopy in the near-infrared wavelength range due to its broad radiation spectrum (Fig. 1). It is also employed in high-volume gas sensing applications, such as measuring CO₂ and hydrocarbons. However, the fragile and thin wire filament does not meet all the requirements of an ideal light source. To ensure reliable and highly accurate measurements, a stable and reproducible filament position is crucial. Achieving this stability involves complex and high-precision manufacturing of light bulbs. Shocks and vibrations might also cause the lamp intensity to flicker and limit the accuracy of measurements. In practical applications, time-consuming effort is often required to position the incandescent lamp correctly.

Improving the filament

The photometric properties of the filament are largely determined by its geometry. The preferred light source is a flat filament with a square light-emitting surface. Most of the emitted light radiates perpendicularly from the flat surface of the filament, aligning with the collection optics for maximum efficiency. INFRASOLID's unique emitter technology provides free-standing metal-sheet filaments made of a monolithic high-melting metal by emitting a broad spectrum of light in the near- and mid-infrared range (Fig. 2). Unlike the tungsten wire filament that can move in all spatial directions during vibration and shock, the metal-sheet filament experiences only very limited movement along one axis, similar to a clamped sheet of paper. This provides higher mechanical and optical stability, enabling more accurate measurements in harsh environments and with hand-held devices. It also eliminates the need for time-consuming lamp positioning.

Customization

Metal-sheet filaments can be manufactured in different sizes and geometries to easily adapt to customer-specific applications. The larger area of the metal-sheet filament results in higher optical output (see Fig. 1). As the availability of broadband emitting LEDs in the near- and mid-infrared spectral range is very limited thermal emitters like the light bulb will continue to be the standard light source for absorption spectroscopic applications.

HIGHLIGHTS

- ☑ Metal-sheet filaments eliminate the need for costly and time-consuming lamp positioning.
- ☑ Higher mechanical and optical stability for more accurate measurements in harsh environments and with hand-held devices.
- ☑ Higher signal strength due to larger metal-sheet filament area.

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