Performance Characteristics of the Ever-Glo™ Mid-IR Source

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KEYWORDS

Infrared source, spectral range, spectral stability, signal-to-noise, long lifetime

INTRODUCTION

The infrared light source makes a significant contribution to the performance of an infrared spectrometer. While it is obvious that the signal-to-noise of the instrument is directly related to the source energy or output, several other critical instrument parameters also depend on the design of the source. These include:

- **Spectral range**
- **Stability**
- **Lifetime**
- **Serviceability**

Nicolet has invested over five years of research and development in the Ever-Glo source. The combination of a proprietary source element, optimized optical layout and ultra-high efficiency insulating material has resulted in a source that provides the high performance of a water cooled source with the ease of use and low power consumption of a standard air-cooled source. Table 1 summarizes the performance characteristics of the Ever-Glo, water-cooled, and air-cooled sources.

To insure the overall quality of the Ever-Glo source, Nicolet has performed an extensive set of experiments to evaluate its performance.

SOURCE INTENSITY

The source intensity must be sufficient to provide a high signal-to-noise level but not so intense as to alter the sample or saturate the detector. Source energy outputs are often evaluated by comparing the relative operating temperatures. While this parameter is useful as a general indicator, specific evaluation can be made by comparing the single beam energy of each source.

The intensities of the water-cooled, air-cooled and Ever-Glo infrared sources are compared using their single beam emission curves. Figure 1 shows the energy curves plotted on the identical Y scale for each of these three sources. To ensure exact comparison, all three sources were run on a Magna-IR® spectrometer with the only difference being the positioning of the source.

These data reveal that the Ever-Glo source provides as much energy as the water-cooled source over the 4000 - 400 cm^{-1} spectral region and significantly more energy than the air-cooled source in the mid-infrared region. The signal-to-noise using the Ever-Glo source on the Magna-IR spectrometer is excellent. Figure 2 shows the result of a 1 minute, 4 cm^{-1} data collect with a signal-to-noise ratio better than 20,000/1.

SPECTRAL RANGE

In addition to the 4000 - 400 cm^{-1} spectral region, the mid-infrared source is also generally used to cover the 400 - 50 cm^{-1} far-infrared region and the first portion of the near-infrared region from 7400 - 4000 cm^{-1}. The mid-infrared source must provide sufficient energy for these spectral ranges without compromise. However, traditional air-cooled sources often perform very poorly in these spectral regions.

We are able to effectively demonstrate the spectral range of the Ever-Glo mid-infrared source by collecting single beam spectra for these spectral regions. Figures 1 and 2 show that by using the appropriate beamsplitter and detector in combination with the Ever-Glo source, we can provide energy for the spectral region from 7400 - 50 cm^{-1}.

TABLE 1

	Ever-Glo	Water-Cooled	Air-Cooled
No External Cooling Required	X		X
High Energy Output	X	X	
Long Lifetime	X	X	

TABLE 1: Summary of performance characteristics of the Ever-Glo, versus water-cooled and air-cooled sources.

STABILITY

Spectral reproducibility and baseline stability of an infrared spectrometer are highly dependent upon a thermally stable source. The Ever-Glo source is an efficient ceramic, refractory composite which rapidly rises to operating temperature and is also thermally insulated to maintain a constant operating temperature.

A water-cooled source requires about 10 times as much input power to provide the equivalent amount of output energy of the Ever-Glo source. Furthermore, the water-cooled source is subject to temperature fluctuations due to the incoming water supply.

Traditional air-cooled sources are designed for low cost and are not insulated. For this reason, an excess input power causes a shortened lifetime.

LIFETIME & SERVICEABILITY

Another disadvantage of an air-cooled source is its limited lifetime; typically 6 to 12 months. Source failure usually results in a service visit, downtime and additional expense. The Ever-Glo source has been extensively tested and found to have a mean time between failure (MTBF) greater than 5 years.

Most source replacements require a service call because the source needs to aligned to the optics of the system. Through precise manufacturing techniques, the Ever-Glo source element is user replaceable. It is pre-aligned and pinned-in-place eliminating the need for a service call or any alignment of the source during installation.

SUMMARY

The Ever-Glo source provides efficient, reliable energy for the 7400 - 50 cm^{-1} spectral region. Its long lifetime and user-replaceable design virtually eliminates downtime due to source failure.

SPECIFICATIONS

Time to temperature: < 3 seconds
Operating Temperature: 1250 ˚C (1577 ˚K)
Material: Proprietary ceramic/refractory composite
Flex Strength: 65,000 psi @ room temp.

REFERENCES

Magna-IR is a registered trademark and Ever-Glo is a trademark of Nicolet Instrument Corporation

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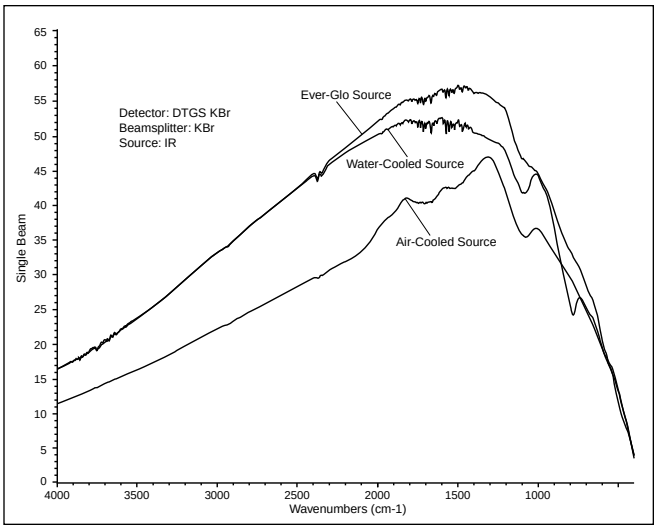

Figure 1

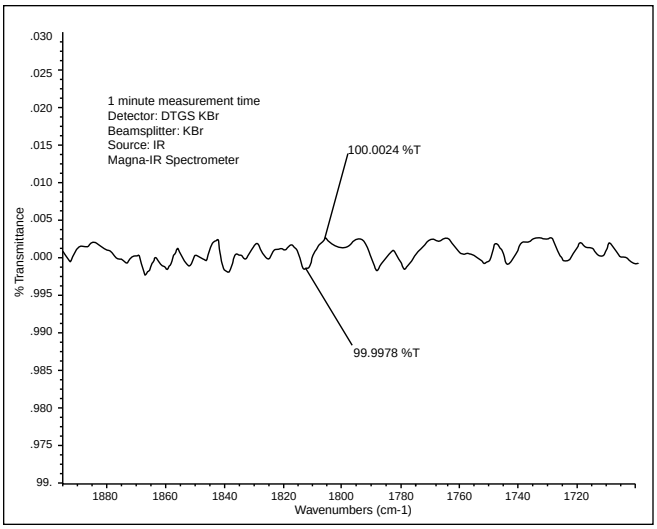

Figure 2

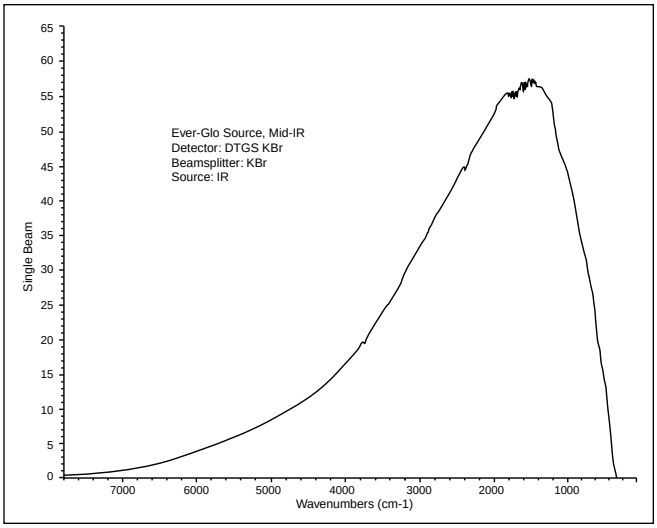

Figure 3

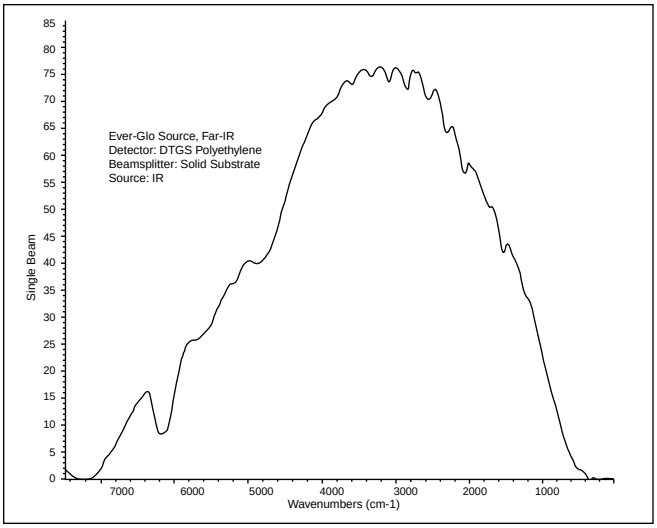

Figure 4

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