Mid-IR Spectrometer — Infrared absorption “finger-print” detection

Introduction
Mid-IR regime is proven to have rich absorption “finger-prints” of materials, demonstrated by benchtop measurement tools, such as Fourier Transform Infrared Spectrometer (FTIR). WOE has established the capability to design and build a portable absorption spectrometer in this regime. The primary objectives are rapid on-site identification of materials by users with minimal training.

Operation Principle
The principle of the spectrometer is based on reflection-based infrared spectroscopy as shown in Figure 1. The Mid-IR spectrometer consists of a) a light source and detector unit, b) a flexible sensor head, and c) a graphical user interface (GUI) for operating, control and processing of acquired data.

The reflective fiber probe is made from chalcogenide glass. The main challenge its design is the efficient coupling in the illumination and collection beam as shown in Figure 2.

The key specifications of the Mid-IR spectrometer are listed below. Compared with similar portable products in the market, our developed device has wider spectral range.

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<th>Optical measurement unit</th>
<th>Optical Specifications</th>
<th>Physical Specifications</th>
<th>Software</th>
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<td>Reflection based</td>
<td>Foot print (max)</td>
<td>GUI</td>
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<td>Rigid probe length</td>
<td>100 - 150mm</td>
<td>35cm(L)</td>
<td>ON/OFF measurement function</td>
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<td>Flexible fiber length</td>
<td>50cm - 100cm</td>
<td>15cm(W)</td>
<td>Display measurement curve</td>
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<td>Spectral range</td>
<td>2.6µm - 4µm</td>
<td>15cm(H)</td>
<td>Output data in text format</td>
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Table 1. Key specifications of Mid-IR spectrometer

Applications
The portable Mid-IR spectrometer can be used in various applications, such as:
• Food quality analysis
• In-situ monitoring for process control
• Remote analysis of gases and vapours
• Investigation of pollutants/degradation pathways
• Clinical chemistry tests

This device also offers a platform to carry out database development and artificial intelligence based spectral training in Mid-IR regime.

Conclusion
As a global enterprise, leading photonics innovation since 2002, WOE has built up customization engineering capability for chalcogenide fiber optics, fiber to free-space optics integration, portable spectrometer integration and precision motion control.