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Application News

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Spectrophotometric Analysis

Benefits of Temperature Controlled DLATGS Detector - Measurement Stability of the IRSpirit-T -

The Shimadzu IRSpirit launched recently is a compact Fourier transform infrared spectrophotometer characterized by the highest signal to noise ratio and the highest maximum resolution in its class (Fig. 1). The dimensions of the body are W376 × D250 × H183 mm and less than A3 in size. The IRSpirit adopts a unique design which allows not only lateral installation but also longitudinal installation so that it can be installed in a narrow space in width. The IRSpirit also has another feature that it can mount the existing accessories such as a single reflection type attenuated total reflection attachment and a diffuse reflection attachment and the commercially available accessories in addition to the accessories for the transmission measurement such as a demountable cell and a KBr pellet holder.

The IRSpirit is comprised of two models according to a using infrared detector. One is the IRSpirit-T mounting a DLATGS detector and the other is the IRSpirit-L mounting a $LiTaO_3$ detector. Of them, a DLATGS detector is a high performance one with temperature control capability and can minimize harmful effects on the measurement caused by temperature change in the measurement environment.

This article introduces the usefulness of temperature control for a DLATGS detector showing the actual measurement results.

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Fig. 1 External View of Shimadzu IRSpirit Compact FTIR

DLATGS Infrared Detector

A variety of infrared detectors are used in an FTIR spectrophotometer according to the measurement purposes. A TGS (triglycine sulfate)-related detector is commonly mounted in it as standard. A TGS-related detector is categorized as a thermal detector and converts infrared energy to heat, which is then converted to electrical signals by the pyroelectric effect or thermoelectromotive force (Seebeck effect). A TGS-related detector which is used as a general-purpose detector has the long operable wavenumber range and is available at room temperature*1.

A Shimadzu FTIR spectrophotometer mounts a DLATGS detector. In DLATGS, glycine in TGS is partially replaced by L-α alanine and additionally hydrogen in glycine and L-α alanine is replaced by deuterium. Temperature control of the DLATGS element ensures the stable measurement.

Measurement of Silicon Oil in Paraffin Oil

Paraffin oil containing 1 % silicon oil was measured with a single reflection ATR attachment. The measurement conditions are shown in table 1. The measurement result is shown in Fig. 2. Fig. 3 expands the range surrounded by a green square in Fig. 2. The peaks of silicon oil are marked by asterisks.

Table 1 Measurement Conditions

Instrument	:	IRSpirit-T QuestATR (Wideband diamond disk)
Resolution	:	4 cm^{-1}
Accumulation	:	20
Apodization	:	Happ-Genzel
Detector	:	DLATGS

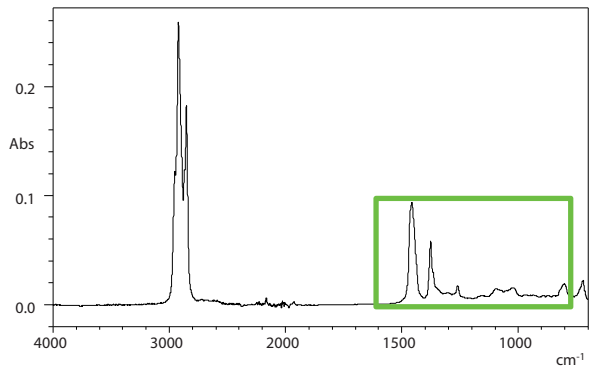

Fig. 2 Infrared Spectrum of Paraffin Oil Containing Silicon Oil

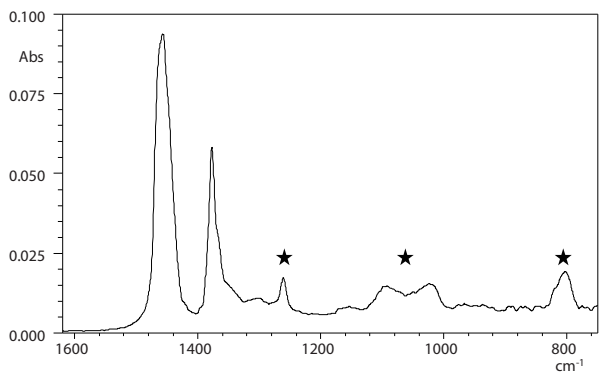

Fig. 3 Expanded Spectrum of Fig. 2

Examination of Measurement Stability

Generally, the content of a target component can be determined with its peak intensity or peak area. When a small peak of a component with a low concentration is used for the determination, it is important to examine the measurement stability of a using FTIR spectrophotometer.

The measurement stability of the IRSpirit-T is not affected by change over time of environmental temperature because a DLATGS detector is controlled at a constant temperature. If the detector doesn't have temperature control capability, it can be affected by heat emitted by an instrument and environment temperature. The fluctuation of temperature of the element makes the measurement result worse.

The measurement stability was examined by repeating the measurement of the paraffin oil sample dropped on an ATR prism ten times continuously. The results are shown in Fig. 4. Fig. 4 (a) and (b) show the results measured without temperature-controlling a DLATGS detector and by controlling it, respectively. The results indicate that a detector controlled at a constant temperature provides more stable spectra without fluctuating the baseline.

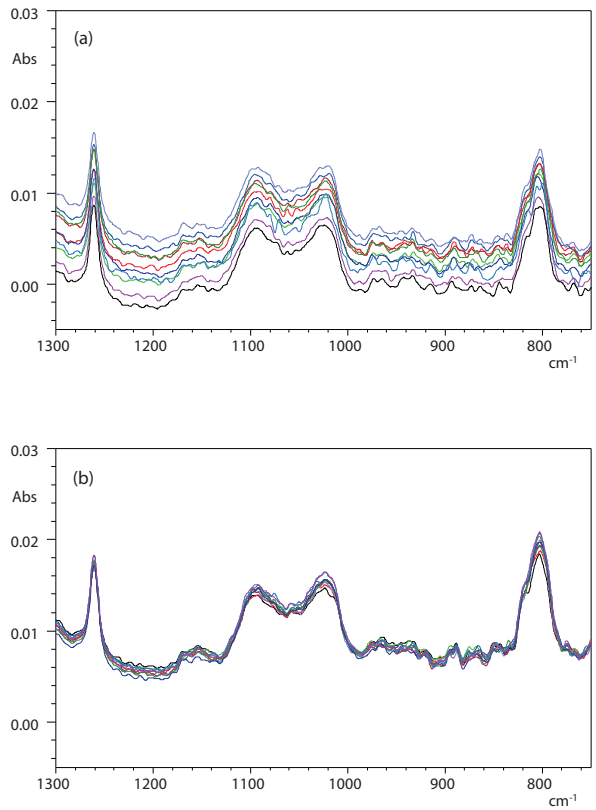

Fig. 4 Comparison of Results Measured without Temperature-Controlling DLATGS Detector and by Controlling It
(a) Not Temperature Controlled (b) Temperature Controlled

Conclusion

A DLATGS detector mounted in the IRSpirit-T and the usefulness provided by the temperature control capability are demonstrated in this article showing the actual measurement results. The IRSpirit-T is not affected by change over time of environmental temperature and ensures the stable measurement.

Reference
*1 : FTIR TALK LETTER Vol.12, Shimadzu Corporation

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