SHIMADZU
Excellence in Science

Application News

No.A520

Spectrophotometric Analysis

Example Analyses Using MicromATR Vision Single Reflection ATR Accessory with Internal Viewing Scope

This article describes the new MicromATR Vision single reflection ATR accessory with internal viewing scope. Although infrared microscope can be used to observe and analyze small quantities of samples or to directly analyze specific locations in a sample, the sample pretreatment required for these analyses can be troublesome. Analysis can be performed quickly using the MicromATR Vision while observing the measurement position in real time without sample pretreatment.

What Is MicromATR Vision?

Czitech's MicromATR Vision is a single reflection ATR accessory for use with mid-infrared measurements. The accessory is shown in Fig. 1. Equipped with a diamond prism, the accessory is capable of measurements in the range of 4000 to 400 cm^{-1}. An internally mounted video camera can also be used to observe sample positioning and contact condition in real time during measurement. Fig. 2 shows the optical diagram of MicromATR Vision. The video viewing software e-Sport is used for sample observation. A screen capture of the software is shown in Fig. 3. The software can be used to save both still and moving images, enlarge images, insert text, and measure sample lengths using a scale function.

The clamp used to hold the sample against the prism also comes with a torque limiter, which prevents excessive pressure and damage to the prism. A pressure sensor can also be attached.

If sample observation is not needed during measurement, a MicromATR model without internal video camera is also available. The MicromATR model without video camera can also be upgraded to the MicromATR Vision model. Both models have equivalent optical performance. A variety of prism options are available for the MicromATR, suited to different sample types. Prisms include diamond 3/9 reflection prism plates, and a Ge single reflection prism plate. Highly acidic samples and some other sample types cannot be analyzed due to the use of stainless steel in the metal parts of these prism plates, though these samples can be measured by changing from stainless steel to Hastelloy alloy.

Fig. 1 MicromATR

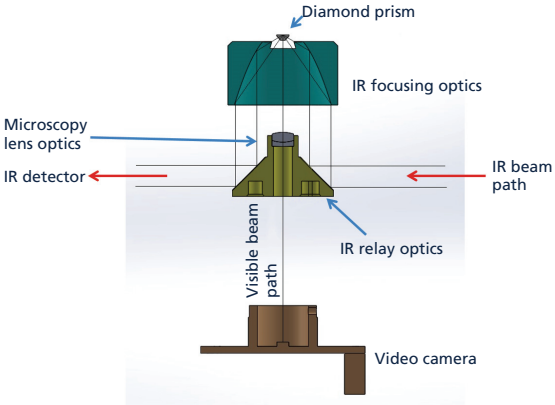

Fig. 2 Optical Diagram of MicromATR Vision

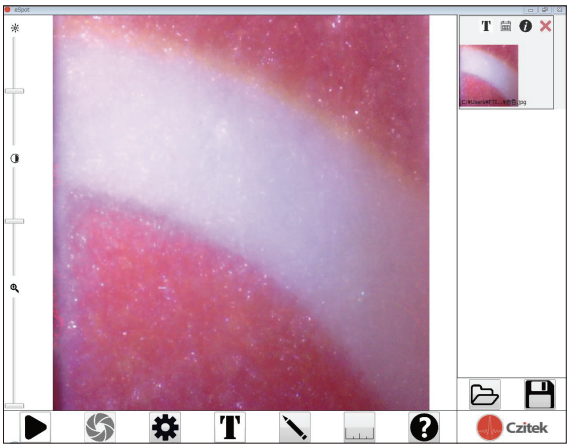

Fig. 3 e-Spot Video Capture Software

Example Analysis 1: Fiber-Like Contaminant on Toy

A red fiber-like foreign substance became attached to a toy. The sample is shown in Fig. 4. The fiber-like contaminant was removed and viewed using MicromATR Vision. An image captured with MicromATR Vision is shown in Fig. 5. Samples with a diameter smaller than the prism can be measured by checking captured images in real time.

Fig. 4 Image of Fiber-like Contaminant on Toy

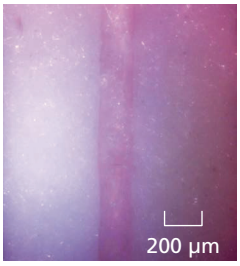

Fig. 5 Video Image of Fiber-like Contaminant

The fiber-like contaminant was removed together with part of the toy for analysis. Analytical conditions are shown in Table 1. ATR spectra obtained from the fiber-like contaminant and toy are shown alongside a spectra search result in Fig. 6. The fiber-like contaminant is made of the same acrylonitrile butadiene styrene (ABS) as the toy, and is presumed to be a cut fragment of the material used in the toy that became attached to the toy during the manufacturing process.

Table 1 Equipment and Analytical Conditions

Instruments	: IRAffinity-1S, MicromATR Vision (Diamond prism)
Resolution	: 4 cm^{-1}
Accumulation	: 40
Apodization	: Sqr-Triangle
Detector	: DLATGS

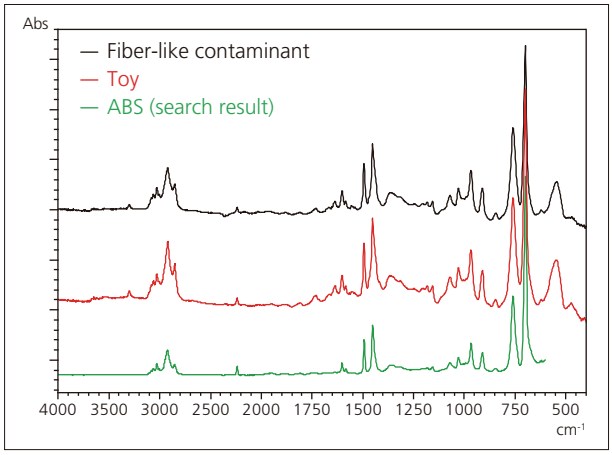

Fig. 6 ATR Spectra and Search Result

Example Analysis 2: Blue Ink

A character printed in blue ink was analyzed. The sample is shown in Fig. 7. The width of the character is almost the same as the diameter of the diamond prism. Analysis can be performed quickly using MicromATR Vision as it allows the operator to confirm visually the sample is in the middle of the diamond prism. A captured image is shown in Fig. 8. The image in Fig. 8 is the part of Fig. 7 outlined in red after enlargement.

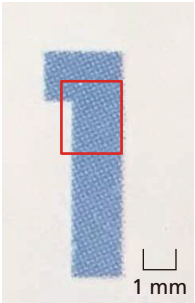

Fig. 7 Image of Blue Character

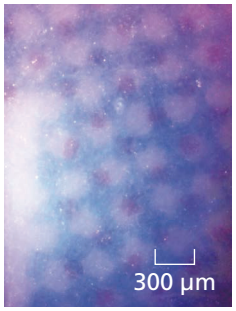

Fig. 8 Video Image of Blue Character

Analysis of the blue ink and paper underneath (white area) showed a slight difference between the ATR spectra of each, as shown in Fig. 9. The paper spectrum was subtracted from the blue ink spectrum to calculate a differential spectrum. The differential spectrum and spectrum search results are shown in Fig. 10. Results showed the blue ink is composed of phthalocyanine blue (organic blue pigment), calcium carbonate (extender pigment), and fatty acids (drying oil).

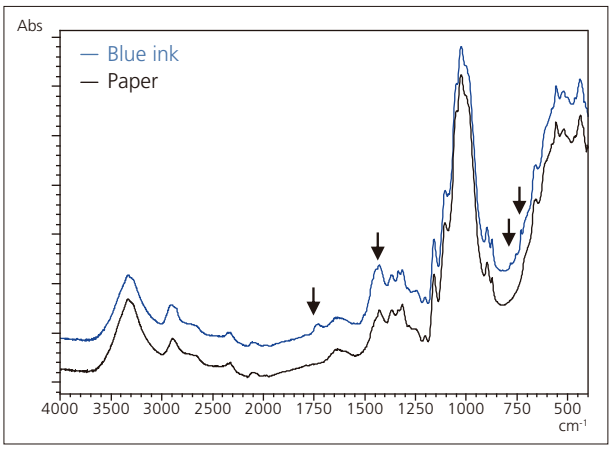

Fig. 9 ATR Spectra of Blue Ink and Paper

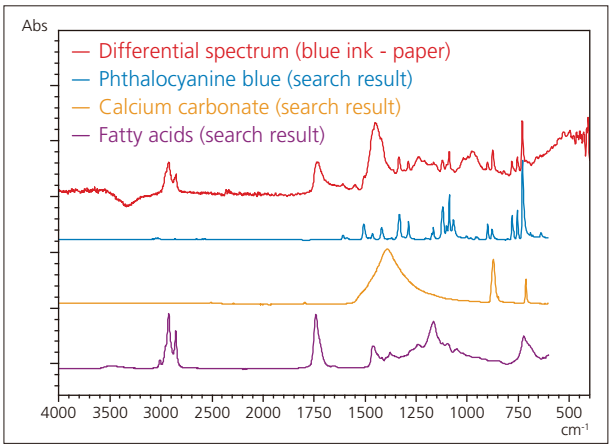

Fig. 10 Differential Spectrum and Search Results

Conclusion

The MicromATR Vision single reflection ATR accessory was used to analyze a sample while also observing the sample in real time. The ability to observe the sample in real time during measurement makes the analysis of visible samples and samples 200 µm or smaller in size that normally require an infrared microscope easier, since it allows the sample to be placed in the center of the prism.

First Edition: Dec. 2016

SHIMADZU

Shimadzu Corporation

www.shimadzu.com/an/