Wide area ATR imaging measurement by ATR-5000-MG

Introduction

JASCO's infrared microscopes have a "IQ mapping" function which enables the imaging measurement by moving optical axis without moving the sample stage. IQ mapping exhibits its power especially in micro-ATR method. In the ATR method, the sample and the prism are brought into close contact with each other. By using IQ mapping, imaging measurement can be performed while keeping this close contact state. As a result, there are merits that cross-contamination can be prevented and the time to move the stage becomes unnecessary. In addition, since the pressure sensor controls the adhesion pressure, spectra with good reproducibility can be measured regardless of the measuring person. JASCO has developed a wide variety of micro ATR objective, but this time we developed the ATR-5000-MG which is capable of wide area imaging. In this report, we introduce the feature and the measurement example of ATR-5000-MG.

Feature of ATR-5000-MG

<Wide measurement area>

Imaging measurement of 400 x 400 µm which is 5 times or more than the conventional measuring area is possible with a single close contact. It is useful for analysis of the distribution state of a relatively wide area such as deteriorated state of rubber and component distribution of food.

<Easy sampling>

Measurement can be performed by simply placing the sample on the sample holder on the stage.

<Correspond to a high refractive index sample>

Germanium is adopted as a prism and it is possible to correspond to a sample with the maximum refractive index of 2.2. Measurement can be possible without spectral distortion even for high refractive index samples such as carbon containing rubber.

<Fine pressure control is possible>

Pressure control in 10 stages is possible from 0 to 0.9 kgf. By closely adhering with a weak pressure, soft sample can be measured without crushing. It is also possible to track the state change of the sample by pressurization.

Fig. 1 IRT-7200 + ATR-5000-MG

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Measurement example: track of the state change by pressurization

The component distribution of the surface of cooling capsule in a commercially available cooling gel sheet and the change of surface condition accompanying pressurization were evaluated.

When cooling capsule pressed too much with the prism, the capsule collapses and the liquid inside seeps out. Therefore the condition of the capsule surface changes by pressurization. In this case, the surface condition of the capsule was measured by setting the adhesion pressure to 0.4, 0.7 kgf. The adhesion was released after the measurement, then the state of the prism surface without contact with the capsule was measured.

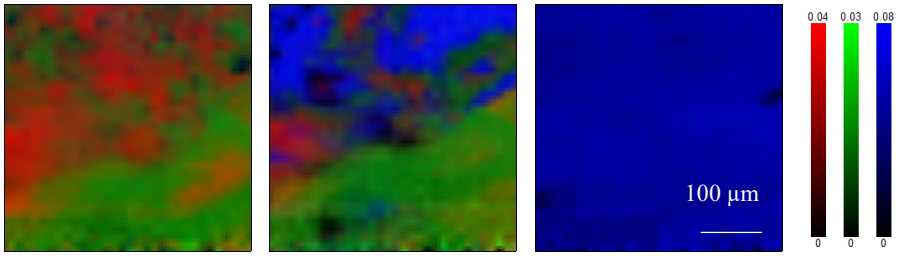
<Measurement condition>

Instruments:	FT/IR-4600 + IRT-7200	Detector:	Linear-array detector
Objective lens:	ATR-5000-MG	Accumulation:	100 times
Imaging area:	400 x 400 µm	Points:	32 x 32

Results

The visible image of the sheet before contact was shown in Figure 2, and the component distribution at each contact pressure was shown in Figure 3. And IR spectrum of each component was shown in Figure 4. When the pressure was 0.4 kgf, only the components of gel and capsule epidermis were detected. On the other hand, when the pressure was 0.7 kgf, the components of the liquid in addition to the gel and the capsule epidermis have been detected. Moreover, only liquid component was detected from the prism after releasing the contact. From this result, it is thought that the capsule is not crushed at 0.4 kgf, and the capsule collapses and liquid seeped out to the capsule surface at 0.7 kgf. After releasing the contact, it is considered that the exuded liquid adheres to the surface of the prism and spreads over the entire measurement area. The change in surface condition of the capsule by pressurization could be evaluated by ATR imaging measurement of wide area while varying the adhesion pressure.

Fig. 2 Visible Image (Before contact)



0.4 kgf | 0.7 kgf | 0 kgf (After releasing the contact)

Fig. 3 Component distribution in each pressure
Blue: liquid in capsule, red: gel, green: capsule epidermis

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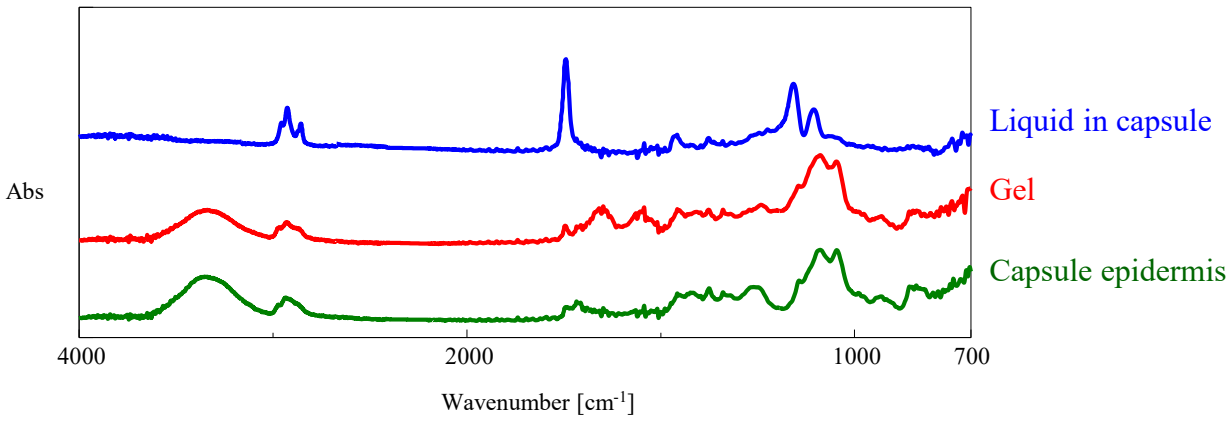

Fig. 4 IR spectrum of each component

Summary

In this report, we reported measurement example combining ATR-5000-MG which can perform the imaging measurement of wide area, IQ mapping function which can perform imaging measurement without moving the stage, and pressure sensor which can control adhesion pressure. In addition to evaluating the change of the surface condition by pressurization introduced this time, we believe that it can be applied to measurement of soft samples such as soft materials and biological samples, analysis of component distribution of blended polymers and rubbers, foods etc. .

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