SHIMADZU APPLICATION NEWS

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● SPECTROPHOTOMETRIC ANALYSIS

No.A357

# NIR(Near Infrared) Mapping using IR Microscope

The measurement range with an infrared (IR) microscope fitted with an MCT detector is normally 5,000 - 700cm$^{-1}$. In order to measure spectra in the near infrared (NIR) region with an IR microscope, it is necessary to change the FTIR light source and beam splitter. Shimadzu's new FTIR model IRPrestige-21 allows measurements in the NIR region by using the NIR kit, which includes a tungsten-iodine lamp, $CaF_2$ beam splitter, and InGaAs detector.

Here we introduce an example of mapping in the NIR region by the transmission method, which was performed using an IR microscope and IRPrestige-21 fitted with the NIR kit.

## ■ Outline of NIR Microscope

For the IRPrestige-21 NIR kit is available which enables measuring in the range 12,500 - 3,800cm$^{-1}$,. This kit includes a tungsten-iodine lamp, a $CaF_2$ beam splitter, and an InGaAs detector. The light source and detector can be installed in parallel with the standard light source and detector. In this example, the MCT detector provided with the IR microscope was used. Fig. 1 shows the optical system of the FTIR microscopy in the NIR region that is capable of analyzing micro areas in the wavenumber range of 10,000 - 2,000cm$^{-1}$.

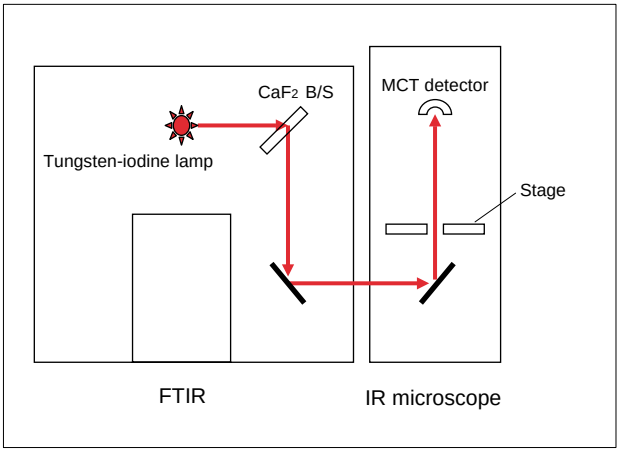



**Fig.1 Optical Diagram of NIR FTIR microscopy**

## ■ Mapping of Adhesive between Glass Plates

A characteristic of NIR spectra is that absorption in the NIR region is markedly weaker compared with that in the mid IR region. Therefore, it is possible to make transmission measurements even with thick films. Here we introduce the results of mapping measurements on an adhesive sandwiched between glass plates.

Fig. 2 shows a two-liquid-mixing epoxy adhesive sandwiched between two glass plates. Appropriate amounts of agent A (epoxy resin) and B (polyol) were mixed on a glass plate, and covered by another glass plate using a spacer of 0.5mm thick. The glass plates were 1mm thick. Fig. 3 shows the image obtained using the mapping software. Mapping was performed on the region under the blue grid, using the conditions shown in Table 1.

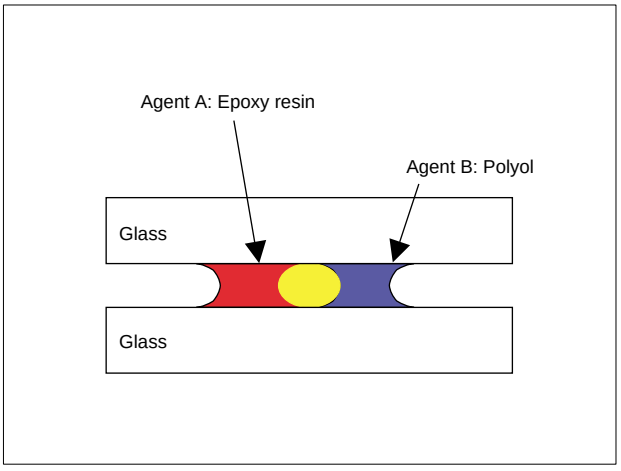



**Fig.2 Diagram of Adhesive between Glass Plates**

The spectra at four points are shown in Fig. 4. Peaks characteristic to the epoxy resin are observed at 6,071 and 4,528 cm-1. The intensity distributions for these peaks are shown in Fig. 5. The peak at 6,071 cm-1 is caused by the first harmonic of the C-H stretching vibration of the epoxy radical. The mapping result shows that the epoxy radical exists only as far as approximately the center where adhesive A and B are mixed. On the other hand the peak at 4,528 cm-1 is thought to be due to the combination of the C-H stretching and bending. This peak can be found in the region of the agent A, as well as the reaction area.

**Table 1 Analytical Conditions**

| | |
|---|---|
| Resolution | : 8cm$^{-1}$ |
| Accumulation | : 10 |
| Aperture Size | : c100µm |
| Step | : 100µm |
| Detector | : MCT |

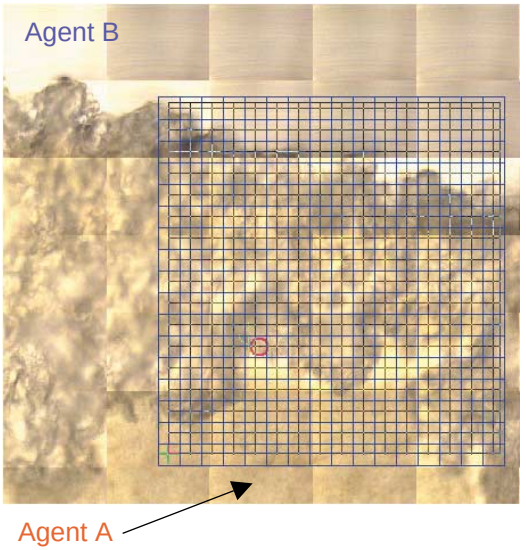



**Fig.3 Result of Scanning View**

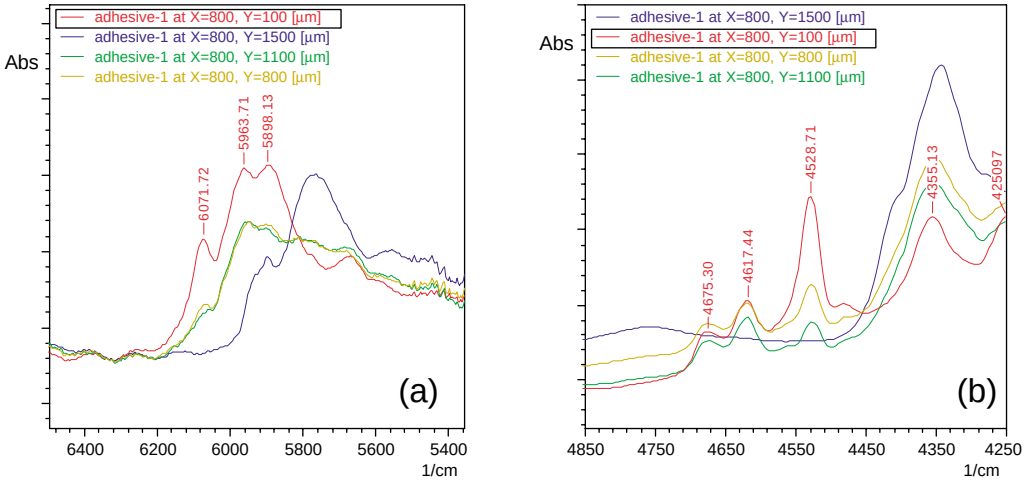
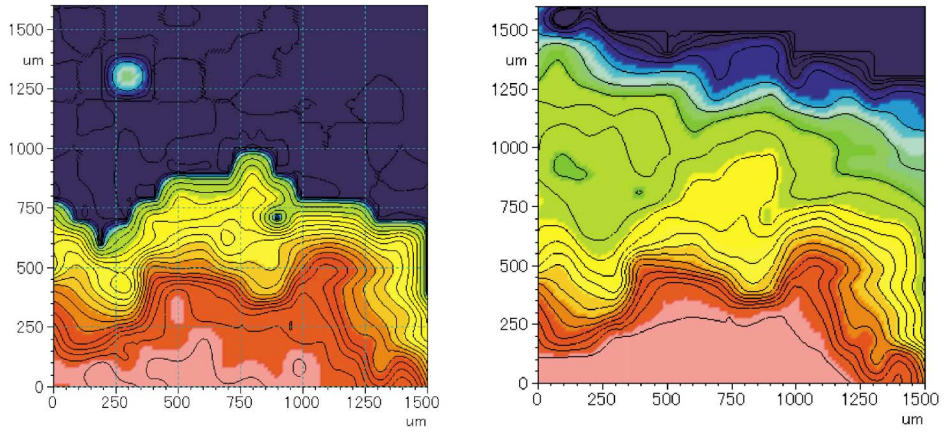



**Fig.4 NIR Spectra at Four Points**




(a)Value of corrected height 6200-6020 [Arb.Units] (b)Value of corrected height 4500-4582 [Arb.Units]

**Fig.5 Contour Map of Peaks at 6,071 and 4,528 cm$^{-1}$**

SHIMADZU

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