Application Note

No. 030MT0194-E

Analysis of Foreign Compounds using IMV-4000

Introduction

The multichannel IR microscope IMV-4000 is an IR microscope provided with a 16-element linear array-type MCT detector. A linear array MCT detector combined with high-speed scanning FTIR, a high-precision auto-stage, and a high-speed parallel data processing circuit enables the mapping measurement of up to 9,600 points per minute. By this combination the measurements can be done in 100 times shorter time than conventional mapping measurements using a single element. In addition, when using a single-element detector to measure samples in which multiple components are contained, it is difficult to identify a single component by an observation image alone because such component is non-uniformly distributed and there are cases where multiple components are being measured simultaneously. In this case a spectrum in which all the components are added together is measured, and when qualitative analysis by a search program is performed on this spectrum, it is extremely difficult to accurately separate and analyze each component because the database of search programs are comprised of single components. It is possible to separate the compound of multiple foreign substances, even using a single-element detector to perform mapping measurements with the narrow aperture size and a long time for measurements, but it will take an extremely long time to identify all components.

In comparison, using the IMV-4000 to perform the wideband mapping measurements is an extremely powerful way to characterize biological samples and multilayer film samples among others types of samples because it can efficiently separate multiple components that are spatially distributed by using its minute aperture.

In this latest example, the IMV-4000 was used to perform IR mapping of foreign substances contained within resin for spatially separating and analyzing microscopic regions. After microscopic mapping measurement was performed, a search program (Sadtler) was used to analyze the characteristic spectra obtained from each region. There were three components identified as: cellulose, polyester, and organic silicon. JASCO's mapping analysis program was, of course, able to create image maps of the measurement area based on the height and area of key band peaks, as well as instantaneously visualize multiple image maps in RGB display. In this example, this function was used to confirm the distribution state of three components by overlaying a color-coded diagram of each key band.

Experimental

The foreign substances within the resin were extracted, a plate was created using KBr, and then microscopic measurement was performed using the transmission method. The foreign substances were identified based on the spectra obtained.

Fig. 1 Foreign compounds in resin

Condition

Detector:	Linear array MCT (16 elements)
Accumulation :	50 times
Objective mirror:	16x cassegrain
Measurement area:	600 x 600 µm (48 x 48 points)
Resolution :	8 cm^{-1}
Measurement method:	Transmission
Measurement time:	Approx. 15 minutes

Measurement Results

Spectra with three different shapes were extracted from the mapping measurement results from the foreign substances overall and then a Sadtler search was applied. There were three spectra able to be identified, and it was confirmed that the foreign substances were of multiple components.

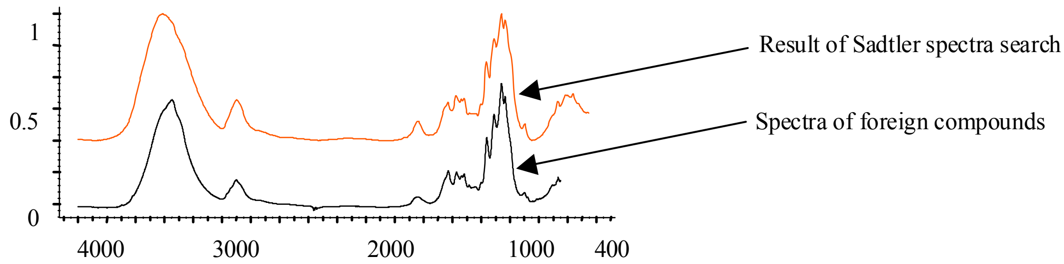

Fig. 2 Search result 1 (Cellulose)

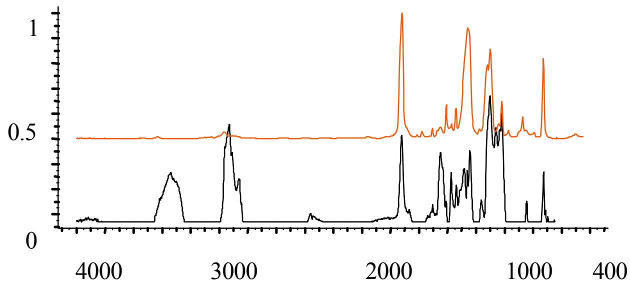

Fig. 3 Search result 2 (Polyester)

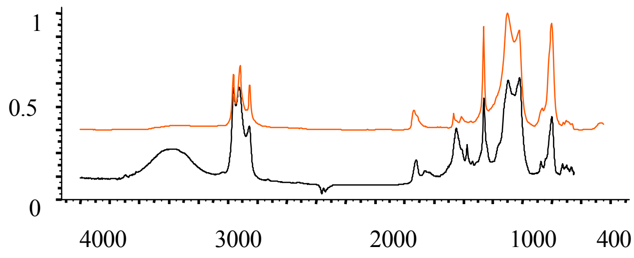

Fig. 4 Search result 3 (Organic silicon)

In addition, the peak specific to each component from above each spectrum are classified by colors. The figure 5 is a distribution state of the specific peaks and an observed image of foreign compounds.

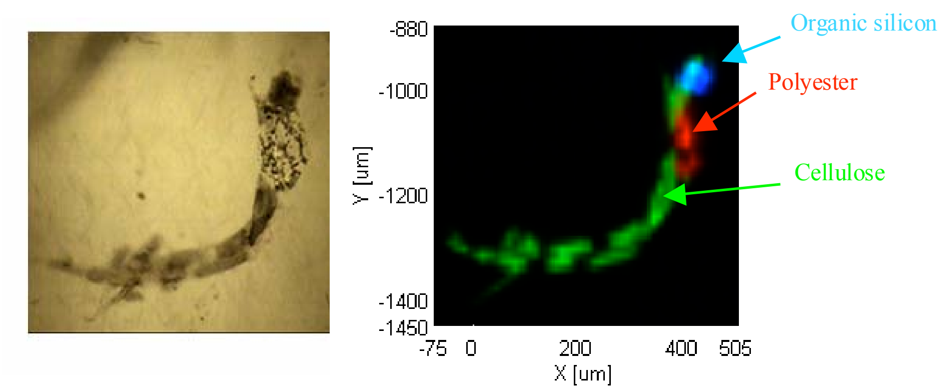

Fig. 5 Observed image of foreign compounds and distribution statet (RGB display)

Green: Cellulose (3344 cm^{-1}) Red: Polyester (1261 cm^{-1}) Blue: Organic silicon (1800 cm^{-1})