

Qualitative analysis of multilayer film for food packaging using shearing holder - Multiple analysis with Infrared microscope-

Introduction

Infrared spectroscopy and Raman spectroscopy are known as a method to complementarily analyze molecular structure from vibration information of molecules. Infrared spectroscopy is widely used mainly in the analysis of organic matter because the information amount is large and the database is substantial. On the other hand, Raman spectroscopy is useful for analysis of inorganic matter and crystal structure because it has a higher spatial resolution compared to infrared spectroscopy and is easy to measure in the low wavenumber range. For this reason, it has been known that a multilateral analysis result can be obtained by combining both measurements. So it has been required to measure the same minute region and the same point by both methods with accuracy and quickly. In order to satisfy these demands, we developed Sharing holder. In this report, the same area of multilayer film for food packaging was analyzed by infrared microscope and Raman microscope by using sharing holder.

Measurement method

A cross section piece of the multilayer film was prepared with a slice master (manufactured by JASCO Engineering Co., Ltd.) and pressed between two KBr plates. The equipment used for measurement and the state of measurement using sharing holder were shown below.

* The order of measurement by infrared microscope and Raman microscope is not affected.

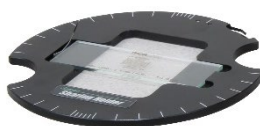
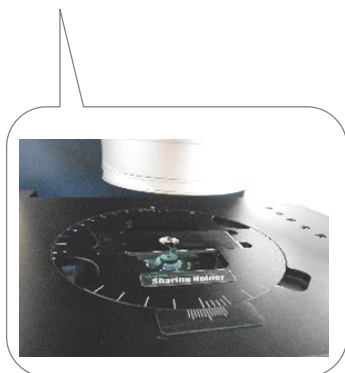
IRT-7200

NRS-4500

FT/IR-6700

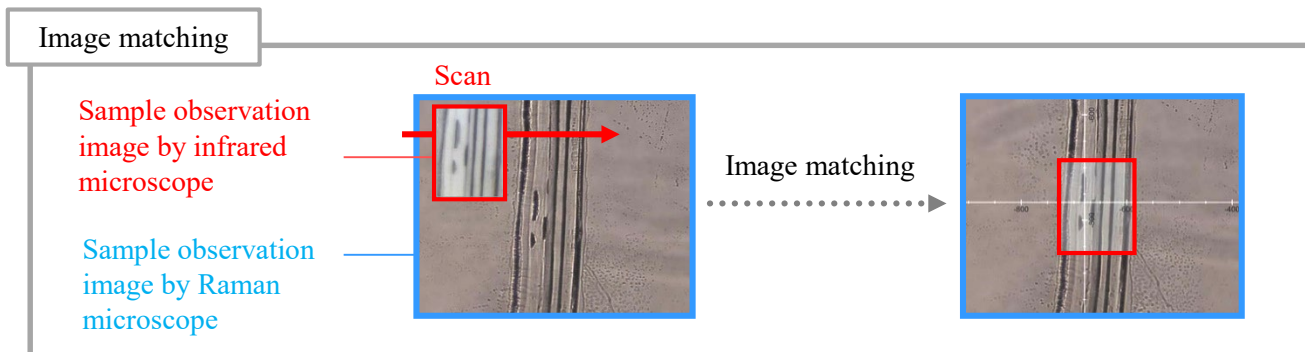


Sharing holder



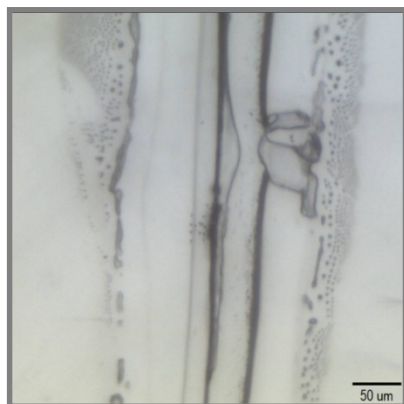
By using sharing holder, it becomes possible to (1) move to the measurement position by the coordinate information, (2) fit the further measurement position based on the coincidence degree of the sample observation image (image matching), so the same minute region and the same point can be measured accurately and promptly.

* A series of operations up to image matching can be done automatically by dedicated software (“IQ Frame” attached to the sharing holder).

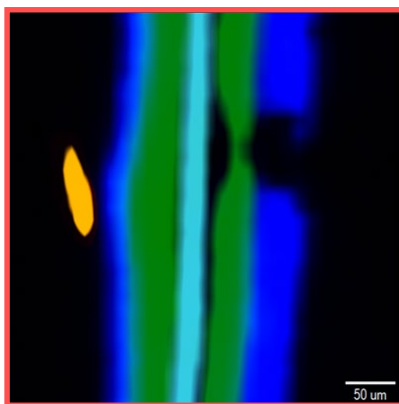


Results and discussion

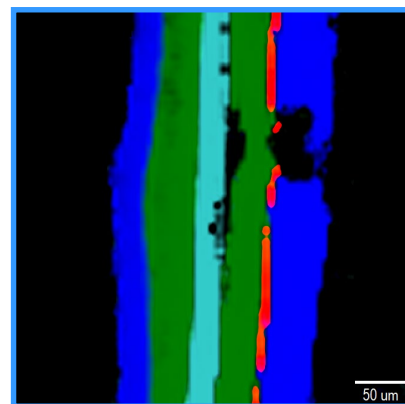
The sample observation image of the cross section of the multilayered film, the principal component spectra calculated by MCR (Multivariate Curve Resolution) and the chemical images calculated by the score of the principal component spectra are shown below. By the result of both principal component spectra and chemical images, it can be seen that distribution state of polypropylene (PP), polyethylene (PE) and polyethylene terephthalate (PET) are able to visualized. On the other hand, cellulose with large infrared activity was specifically detected by infrared microscope, and titanium oxide (TiO₂) was specifically detected as a very thin layer with a thickness of several μm by Raman microscope. Since cellulose is not used in this film, it is suggested that there is the high possibility that the cellulose is mixed foreign matter. By using both systems, the complementary information was acquired.



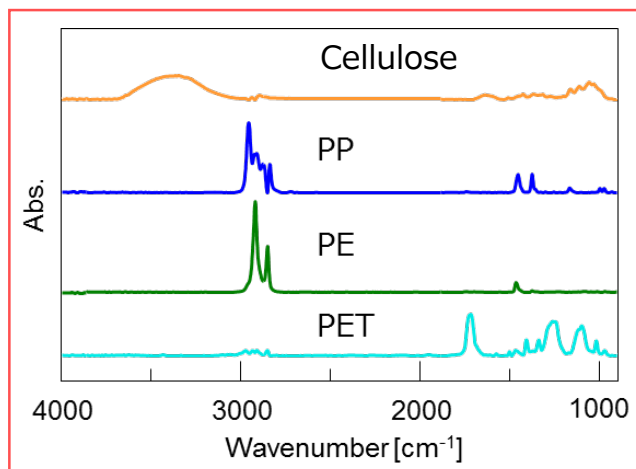
Sample observation image



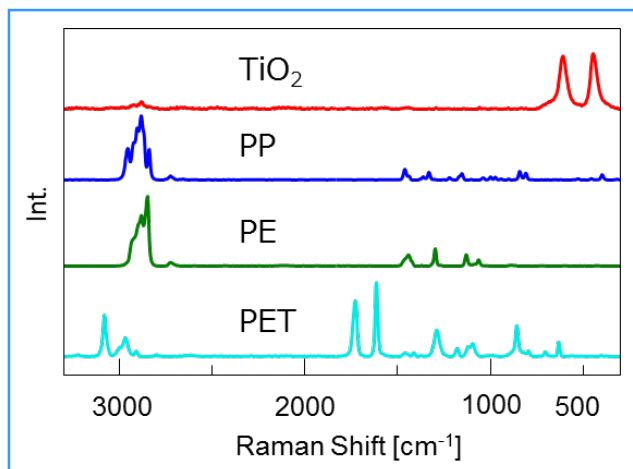
Infrared microscope chemical image



Raman microscope chemical image



Infrared microscope
Principal component spectrum



Raman microscope
Principal component spectrum

Conclusion

Infrared and Raman information in the same area can be obtained quickly and conveniently by using the sharing holder. Sharing holder is useful not only for composite analysis of infrared and Raman, but also for microscopic analysis between different facilities and remeasurement of samples removed once from the stage. We believe that the sharing holder can be used in a wide range of fields such as R&D and quality control of various industrial products, analysis of agricultural products, pharmaceuticals and foods, and difference identification on law science.