Exploring Layered Structure of Composite Films Using FTIR Microscope
Liang Zhao, Sudhir Dahal, Gilbert Vial, Shimadzu Scientific Instruments, Columbia, MD, USA

Introduction
Multi-layered materials are commonly used in various industries such as packaging, construction and medical industries. Multi-layered structures often have a high spatial resolution over the cross section of composite films. Identifying the chemical composition of different layers is important in research and development of composite materials. With the aid of the Shimadzu ATR-5000 FTIR microscope, infrared spectra can be acquired with special attention for the characterization of different layers. The study demonstrates the ability to identify various layers within the composite film. Analysis of the FTIR spectra helps to understand the formation of different layers the polymer film is composed of.

Experimental
The Shimadzu FTIR microscope was setup in combination with the Shimadzu IRTracer-100 FTIR spectrophotometer. The Shimmadzu AIM-9000 FTIR microscope can be used for the study of multi-layered materials and to set the experimental parameters. The optical mapping software allows for scanning and mapping samples in the seven, the cross modes. The “line” mode was particularly useful in the investigation of cross sections of a film sample. By setting an appropriate spectrum size, it is possible to capture high spatial resolution over the cross section of composite films.

Sample preparation is of vital importance in this experiment. Sample preparation was carried out using a Shimadzu IRTracer-100 FTIR Spectrophotometer. The Shimadzu AIM-9000 FTIR microscope was setup in combination with the Shimmadzu IRTracer-100 FTIR spectrophotometer to study the multi-layered composites and its high spatial resolution over the cross section of the sample.

Table 1: Experimental Facial Elements

Sample preparation is of vital importance in this experiment. The composite film under study was received from a commercial source. It was 1-2 mm thick and was cut into smaller size of approximately 0.5 cm x 0.5 cm. It was then loaded into a diamond window and transferred to the Shimadzu IRTracer-100 FTIR spectrophotometer. The AIM-9000 FTIR microscope was setup in combination with the Shimadzu IRTracer-100 FTIR spectrophotometer to study the multi-layered composite films. Analysis of the FTIR spectra helps to understand the formation of different layers the polymer film is composed of.

Conclusion
Shimadzu’s IRTracer-100 FTIR spectrophotometer combined with the Shimadzu ATR-5000 FTIR microscope can be used to analyze the layered structure of composite films. The microscope system allowed measurement in the transmission, reflection and ATR modes. Sample preparation was important in the successful investigation of the film cross section. The Shimadzu FTIR microscope with the optional mapping software proved an indispensable tool in the characterization of different layers within the composite film. FTIR analysis was applied to the C=O bond at about 1640 cm⁻¹ over the cross section of the sample. FTIR analysis can be applied to other IR modes as well.

References
Application Note: IRTracer-100: Characterization of Polymer Film Cross-Section Using the Shimadzu ATR-5000/FTIR Microscope (Shimadzu Scientific Instruments, Columbia, MD, December, 2019).