Application Note
FT-IR: JI-Ap-FT0507-003

# Sample Preparation for Infrared Imaging - Multilayer Film Measurement Using the SliceMaster

There are various devices that can create cross-sections of multi-layer films for analysis of the molecular structure using infrared spectroscopy. To date, cross sections of multilayer laminates have been created by embedding the sample in epoxy resin and then using a microtome to create the cross-section slices. This technique has various drawbacks, including the time required for the resin to harden (several hours for epoxy resin) as well as resin contaminating the sample. In addition, since the IRT-7000 infrared imaging system can dramatically shorten measurement times compared to conventional imaging measurement systems, the need to reduce the time required for preprocessing samples was required. For the creation of cross sections, the SliceMaster developed by JASCO Engineering Co., Ltd., was used. This accessory can provide thin 'slices' or cross sections of various samples, including multi-layer laminates, without embedding them in resin. In this experiment, we used the vertical SliceMaster (HS-1) (Figure 1) to create a cross-section from a food package that was measured using the transmission method of analysis.

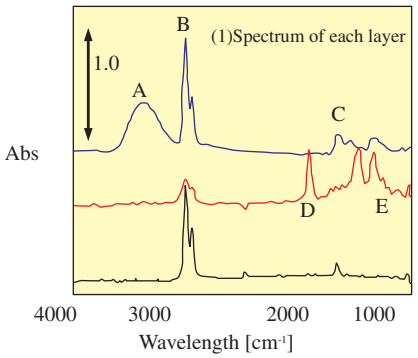
The measurement area was 600 × 600 µm with a spatial resolution of 12.5 µm, collecting 16 scans at 8 $cm^{-1}$ resolution for all spectrum. Based on the spectra collected for each layer, we determined that the laminate was comprised of polyethylene (PE), polyvinyl alcohol (PVA) and poly ethylene terephthalate (PET) (Figure 2 (1)). Figure 2 (2) is the visual image of the sample captured with the integrated CCD video camera in the IRT-7000. Figure 2A is the infrared image based on the peak intensity at 3500 $cm^{-1}$ attributed to the -OH functional group for the PVA material; Figures 2B and 2C are based on the peak intensity for the C-H stretching absorption at 2920 $cm^{-1}$ and the C-H bend at 1440 $cm^{-1}$, respectively, present in all the layers. Figure 2D represents the image based on the C=O peak intensity at 1730 $cm^{-1}$, present in the PET layer, and Figure 2E is the image for the peak intensity of the 1250 $cm^{-1}$ absorption. The infrared images obtained for the sample revealed the clear differences among the four-layer structure.

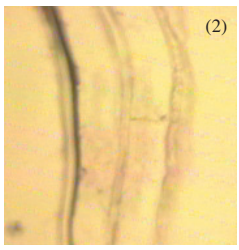
Based on these results, information on the adhesive layers between each film layer could not be obtained, but the use of the HK-1 angled SliceMaster and the 32X cassegrain objective, could provide the ability to obtain greater spatial resolution for analysis of the sample.

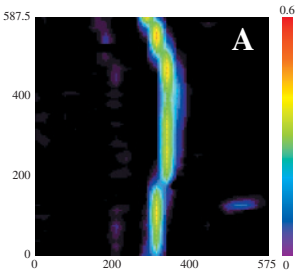
**Figure 1. SliceMaster**

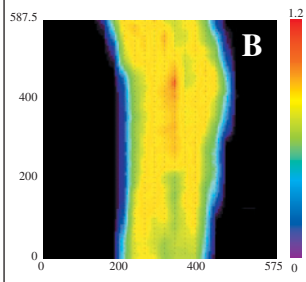

HK-1 angled slicer HS-1 vertical slicer

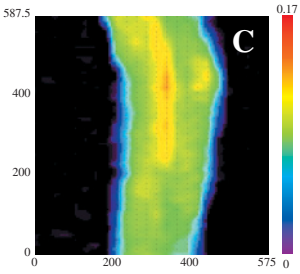
**Figure 2. Multi-layer measurements**

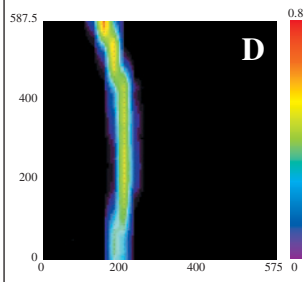


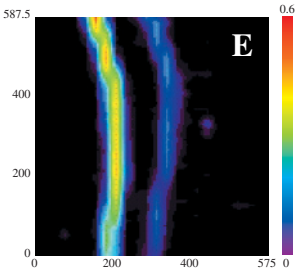



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