

## Evaluation of Polymer Films – Micro FT-IR Imaging

### Overview

Functional polymer films generally possess multilayered structures, according to their functions and applications, and understanding the layered structures is most important. This paper discusses an example of the use of micro FT-IR imaging to the evaluation of the layered structure of a packaging polymer film.

### Method

Micro FT-IR imaging uses a detector consisting of multiple elements to make two-dimensional measurements. It makes visible micro layered structures and distributions based on the characteristic functional group information in chemical compounds.

### Examples

The example is of a cross section of a packaging film approximately 200  $\mu\text{m}$  thick (see Fig. 1). Figures 2 to 4 show the results of micro FT-IR measurements. The measurements were made by Ge-ATR applied to an analysis of the microstructure.

The results in Figs. 2 to 4 show that the packaging film consisted of nine layers: polypropylene (approx. 30  $\mu\text{m}$ ), polyester (approx. 15  $\mu\text{m}$ ), ethylene-vinyl acetate copolymer (approx. 30  $\mu\text{m}$ ), adhesive (approx. 5 -7  $\mu\text{m}$ ), polyethylene (approx. 60  $\mu\text{m}$ ), polyamide (approx. 20  $\mu\text{m}$ ), ethylene-vinyl alcohol (approx. 20  $\mu\text{m}$ ), polyethylene (approx. 15  $\mu\text{m}$ ) and polyester (approx. 10  $\mu\text{m}$ ).

**Measurement conditions;**  
 Method: Micro ATR imaging  
 Wavenumber range: 4000 – 900  $\text{cm}^{-1}$   
 Wavenumber resolution: 8  $\text{cm}^{-1}$   
 Measured area: 35  $\mu\text{m}$  x 225  $\mu\text{m}$   
 Effective element size: 1.1 x 1.1  $\mu\text{m}$ /pixel



Fig. 1 Image of cross section of packaging film.

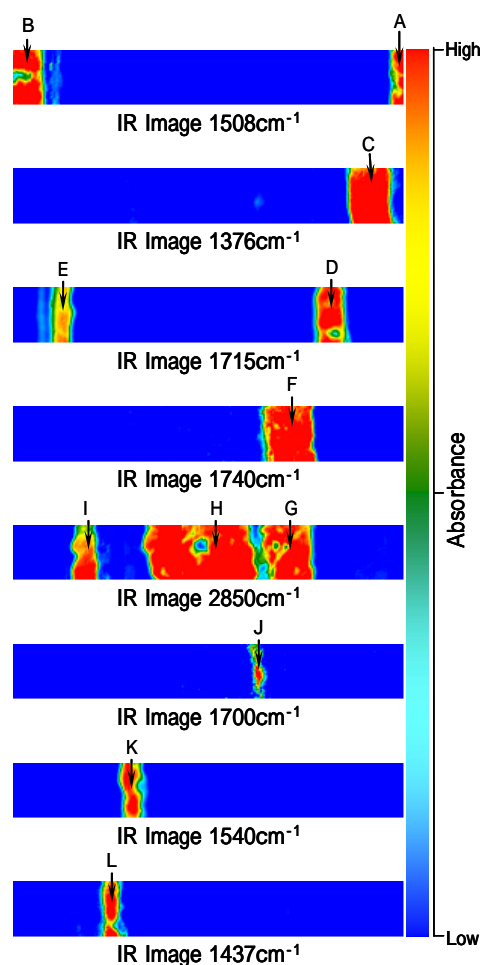


Fig. 2 IR images of packaging film layers.

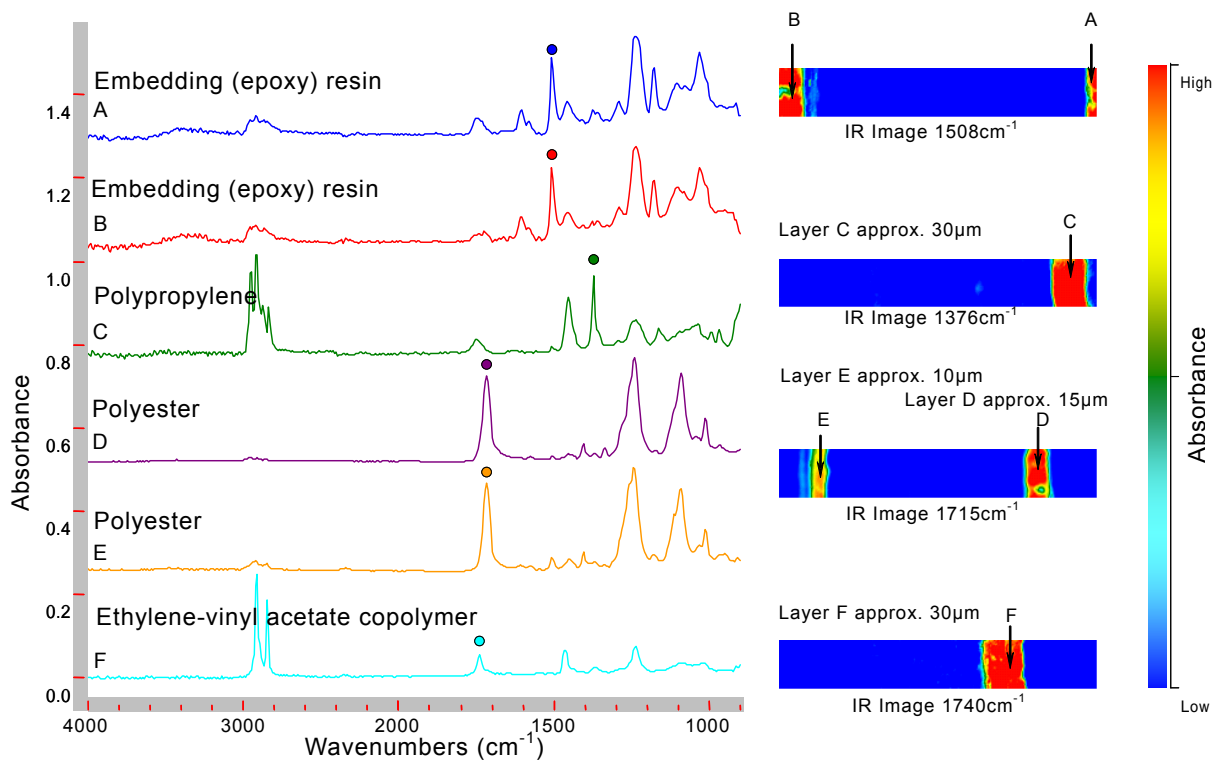


Fig. 3 IR images and FT-IR spectra of packaging film (Layers A-F).

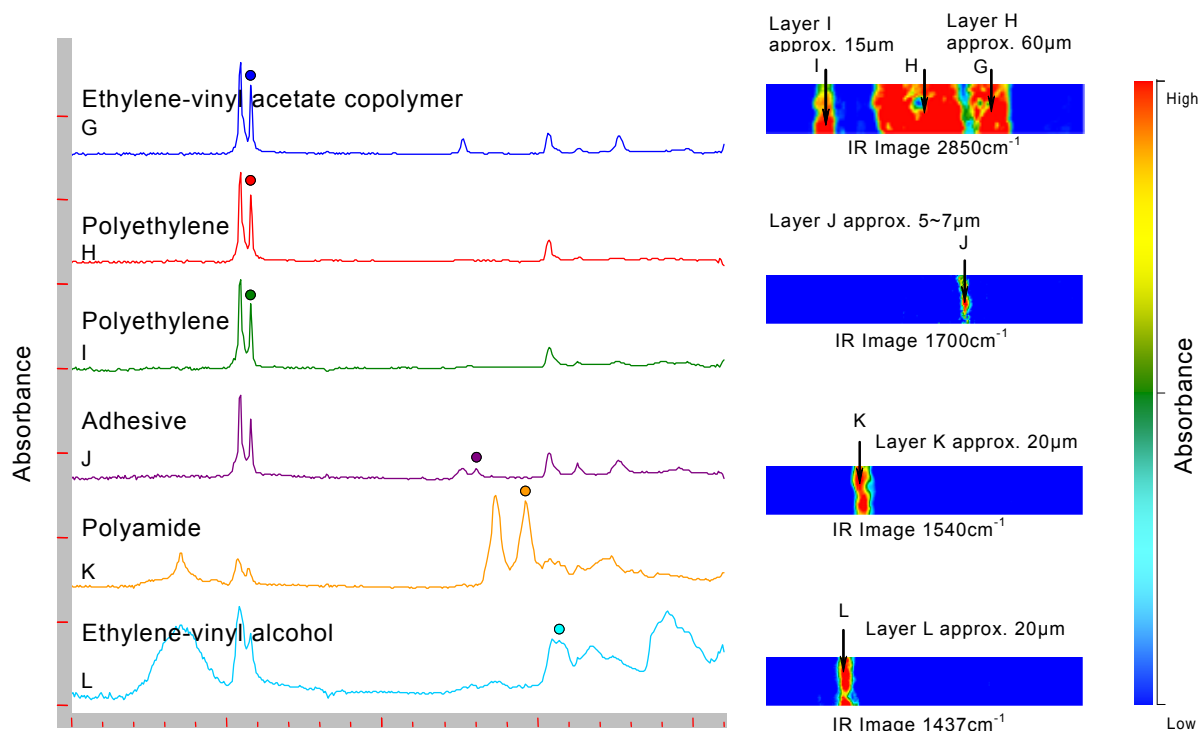


Fig. 4 IR images and FT-IR spectra of packaging film (Layers G-L).

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