HARRICK SCIENTIFIC PRODUCTS

No. 502xx

Detecting Thin Films on Plastic Substrates using Micro-ATR Spectroscopy

Figure 1. The SplitPea™.

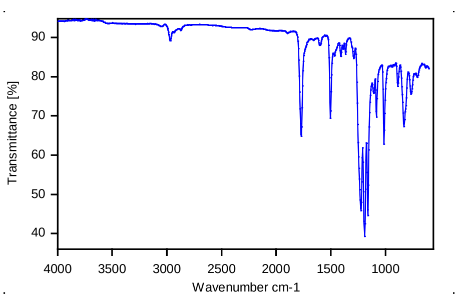

Figure 2. ATR Spectrum of the Cleaned Plastic Substrate.

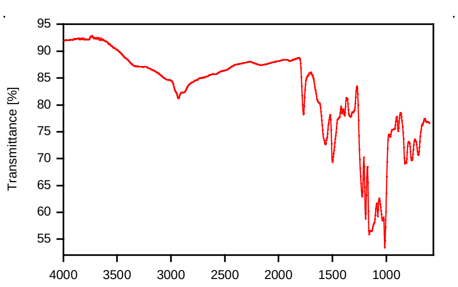

Figure 3. ATR Spectrum of the Coated Plastic.

Introduction

Plastics are frequently coated on other materials. Some plastics are coated during the shaping process to prevent adhesion to molds. Others are more intentionally coated to change the properties of the surface for particular applications.

Thin coatings on plastics are typically tricky to detect by FT-IR spectroscopy. The common sampling methods, transmission and 45° ATR with a ZnSe or KRS-5 crystal, sample too deeply into the material resulting in spectra that show primarily characteristics of the bulk material rather than the coating. In addition, many of these samples are curved like eyeglass lenses making them less amenable to analysis by these methods.

This application note explores the analysis of thin films on plastics by micro-ATR spectroscopy. In particular, the SplitPea will be used to detect and identify a coating on plastic. This micro-ATR accessory is uniquely suited to this application since it readily examines irregular and curved samples and can be equipped with a high refractive index ATR crystal for high surface sensitivity.

Experimental

Two slightly curved samples were examined: a coated plastic and a clean, uncoated piece of the sample plastic. The latter was used as a reference to confirm detection of the coating.

The samples were examined using the Harrick SplitPea (see Figure 1) with its Ge hemispherical ATR crystal. The SplitPea was installed in an FT-IR spectrometer. All spectra were collected with 32 scans at 8 cm^{-1} resolution using a DTGS detector.

The background spectra were collected from the clean Ge ATR crystal. Then the sample was placed on the ATR crystal. The sample was compressed against the crystal using the maximum force allowed by the built-in pressure applicator, prior to collection of the sample spectrum.

Results and Discussion

Figure 2 shows the ATR spectrum of the plastic substrate, while the spectrum of the coated plastic is shown in Figure 3. The substrate itself can be identified as a polycarbonate, by using a standard library spectral search.

From comparison of the two spectra, it is obvious that there are distinct bands in Figure 3 that are due to the coating and not the substrate. The carbonyl band at 1767 cm^{-1} and the 1503 cm^{-1} band are present in both spectra, indicating that there may be a small contribution in the coating spectrum from the substrate.

However, the broad peaks between 3300 and 2500 cm^{-1} show the presence of a carboxylic acid or derivative in the coating which is clearly not present in the substrate.

SUMMARY

In conclusion, thin coatings on plastics can be detected and identified using micro-ATR FT-IR spectroscopy. The SplitPea is an ideal tool for this type of measurement, since it can be equipped with a Ge ATR crystal for low penetration into the sample and can readily accommodate curved or irregularly shaped samples.

HARRICK
HARRICK SCIENTIFIC PRODUCTS
141 Tompkins Ave., 2nd floor • PO Box 277 • Pleasantville, NY 10570
www.harricksci.com • E-mail: info@harricksci.com
Phone (international): 914-747-7202 • Phone (in USA): 800-248-3847 • Fax: 914-747-7209