Introduction
Thin layers of coating materials are widely used to preserve and protect metallic substrates. Specialized coatings are also used to prevent interactions between a metallic container and its contents including food and beverage products. These coatings are specially formulated to provide long-term adhesion, provide an inert barrier to the atmosphere or content and remain durable for the life time of the product. An easy and reliable method for measurement of the identity and thickness of these coatings is specular reflectance infrared spectroscopy also known as reflection absorption spectroscopy (RAS).\(^1\)

For film thicknesses in the range of approximately 0.5 to 50 microns, the analysis can be done relatively easily and simply by using a 30 degree fixed angle specular reflectance accessory shown in Figure 1. The 30 degree incident angle is ideal for these film thicknesses first because the relatively low incident angle maximizes the throughput of the measurement thereby increasing the signal-to-noise ratio (SNR). Secondly the greater than normal angle of incidence increases pathlength of the IR beam through the coating and thereby increases sensitivity. Figure 2 shows the IR beam path used in the PIKE Technologies 30Spec. This accessory will not solve all reflectance sampling needs - for the RAS analysis of very thin layers (such as monomolecular layers) we would recommend a grazing angle specular reflectance accessory with IR polarizer.\(^2\) In the laboratory where a wide range of thicknesses of surface treatments must be characterized, the VeeMax II variable angle specular reflectance accessory would be beneficial.

Experimental and Results
All spectra shown in this note were collected using the PIKE 30Spec on a FTIR spectrometer operating at 4 cm\(^{-1}\) spectral resolution. Samples were placed face down on the accessory and a 1 minute scan time was utilized for sample and background spectra. Background spectra were taken from the aluminized reference mirror included with the accessory.

Figure 3 shows the RAS spectrum of the coating on the inside of an aluminum food container. The quality of this spectrum is excellent and a library search indicates that it consists of an epoxy polymer. A sine wave feature is evident in this spectrum with maxima present at 3280 and 1967 cm\(^{-1}\). This feature is due to reflection between the parallel sur-
faces of the coating. The external surface of the food container was also measured and its spectrum is shown in Figure 4. Again an excellent spectrum is obtained and its library search result indicates that it consists of a polymethyl methacrylate class coating. This spectrum also shows a strong absorbance band at 2085 cm-1 which from library search results is consistent with green pigment.

Discussion
Thin coatings on metallic substrates are easily and quickly measured by FTIR spectroscopy using the 30Spec specular reflectance accessory. The simple optical design of the 30Spec provides excellent quality data within a short measurement time.

References: