

# FTIR Sampling of Residues on Curved Metal Surfaces Outside of the Sampling Compartment



Figure 1. Omni-Spec specular reflection fiber optic probe.

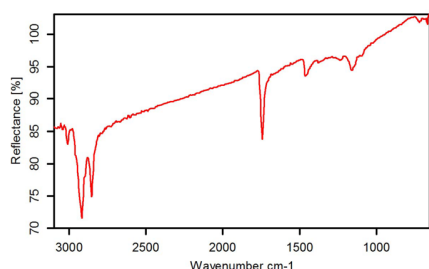


Figure 2. Specular reflectance spectrum of oil on surface of machined steel cylinder.

[FiberMate2](#) coupler. Spectra were collected at an  $8\text{cm}^{-1}$  resolution and signal averaged over 32 scans with an MCT-A detector. The sample investigated was a stainless steel cylinder, 6" in diameter and 4.5" high, with a machined finish. The sample was cleaned for the background measurement, and a thin coating of Mazola oil was applied to the same area prior to the sample measurement. For both the sample and background measurements, the Omni-Spec was held so its sampling surface was tangential to the surface of the sample.

## INTRODUCTION

In the manufacturing process, it frequently becomes important to determine if metal parts are clean or are sufficiently lubricated with oil. Infrared analysis of small, flat pieces can be readily carried out by in-compartment grazing angle specular reflectance. However, parts are frequently large and irregularly shaped or curved, which makes in-compartment analysis trickier. This note explores the use of a specular reflectance fiber optic probe to measure oil on the curved surface of a large metal cylinder outside of the spectrometer sampling compartment.

## EXPERIMENTAL

The measurements were carried out using Harrick [Omni-Spec](#) fiber optic specular reflectance probe with two PIR fibers (Figure 1), interfaced to a commercial FTIR spectrometer through the Harrick

## RESULTS AND DISCUSSION

Figure 2 shows the oil coated metal. As expected, there are C-H stretching bands prominent in the  $2800\text{-}2900\text{ cm}^{-1}$  region, in addition to bands at  $1724\text{ cm}^{-1}$  due to a C=O stretch,  $1462\text{ cm}^{-1}$  due to C-H bends, and  $1160\text{ cm}^{-1}$  from a C-O stretch. Note that there is increased noise about  $3000\text{ cm}^{-1}$ . This is due to the optical cut-off of the PIR fiber. The baseline of the spectrum is also strongly sloped. This is due to the machine finish on the sample which creates shiny and rough areas on the surface. The Omni-Spec collects the specular reflectance in addition to some fraction of the diffused specular reflectance. This combination results in a sloping baseline.

## CONCLUSION

Specular reflection fiber optic probes such as the Omni-Spec can be used effectively to examine coatings and residues on large, curved metal surfaces, provided that care is taken in positioning the probe relative to the sampling surface. The Omni-Spec fiber optic probe operates outside of the spectrometer sample compartment, making it a useful tool for examining large samples.