

Analysis of Fibers by Micro-ATR Spectroscopy



Figure 1. Harrick's Video Meridian ATR

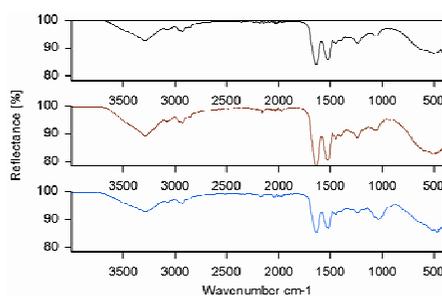


Figure 2. The ATR spectra of a single hair from a human (top), a guinea pig (middle), and a pony (bottom). A sample video output of the guinea pig hair is shown for reference

INTRODUCTION

Identification of organic fibers and other small samples is extremely important to forensics and to quality control for manufacturing facilities. An excellent method for examining these types of samples is FT-IR ATR spectroscopy. However, to obtain the optimum performance from ATR, the ATR accessory must have a small sampling area on the ATR crystal, the ability to accurately position the sample on that area, and a wide wavelength range.

A new accessory has been developed to meet these requirements. This accessory, the Video Meridian™, is an adaptation of Harrick's time-tested SplitPea™¹ with:



- True-color viewing of the sample through the crystal and image capture capabilities

- An unbreakable solid diamond ATR crystal.
- The smallest sampling surface available - 500 μm in 'diameter'.
- An unrestricted spectral range from the UV to the FIR.
- Readily available and interchangeable alternative

ATR crystal materials, including Si, Ge and ZnSe.

- A calibrated pressure applicator with digital force display and capable of extremely high contact pressures.

Several examples are shown here.

EXPERIMENTAL

The ATR measurements were recorded using Harrick Scientific's Video Meridian™ on an infrared spectrometer equipped with a DTGS detector. To obtain good contact, the samples were pressed against the ATR crystal. The spectra were collected at 8 cm^{-1} resolution and 32 scans were signal averaged. With each spectrum, an image was also captured.

RESULTS AND DISCUSSION

The ATR spectra and video output for several fibers are shown in Figures 2 and 3. Figure 2 shows the spectra of hair from several different animals. The pony hair shows a stronger band near 1040 cm^{-1} , indicating that it is more oxidized than the others², probably due to sun exposure. Along with the spectra is a

M. Milosevic and S. L. Berets, Appl. Spectros. 45 (6), 944 (1991).

2L. Brenner, P.L., M. Garry, and C. S Squires. Tumosa, J. Forensic Sci. 30(2), 420 (1985).

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photograph of one of the hairs on the crystal. Note that the active sampling surface of the ATR crystal is in the shape of an octagon and is approximately 30% covered.

Figure 3 shows the spectrum and photograph of a bundle of 20 μm diameter PET fibers, along with a photograph of the sample. The photograph clearly shows that the bundle consists of five separate fibers, each of which could also be examined individually.

As demonstrated here, the Video Meridian™ is a powerful tool for examining fibers and keeping a photographic record of the samples analyzed.

References

¹ N. J. Harrick, M. Milosevic and S. L. Berets, *Appl. Spectros.* 45 (6), 944 (1991).

¹ L. Brenner, P.L. Squires, M. Garry, and C. S. Tumosa, *J. Forensic Sci.* 30(2), 420 (1985).



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