Correlating the Polarizer Indicator to S- And P-Polarization Via ATR

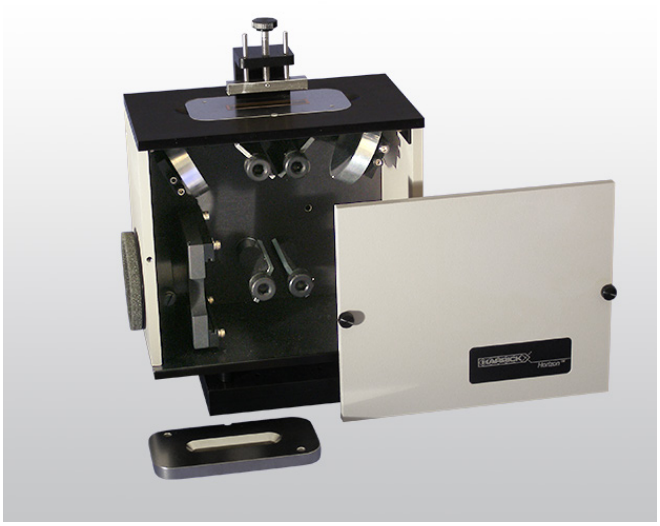

Figure 1. The Horizon ATR Accessory.

INTRODUCTION

Commercial infrared polarizers typically have an indicator showing the orientation of the polarizing element in its mount. The polarizer manuals generally relate the direction of the electric field vector to the indicator. This can then be correlated to the direction of the sample plane to determine which polarization, parallel (p) or perpendicular (s), impinges on the sample.

For transmission, this relationship is straightforward. For reflectance, an accessory is usually used to direct the infrared radiation to and from the sample via mirrors, and this can rotate or even scramble the direction of the electric field. While the desired polarization can be determined theoretically, it is not always easy to do so. If the polarizer manual or the optical layout of the accessory are unavailable, it becomes difficult to use solely theoretical considerations.

However, the orientation of the polarizer can also be determined experimentally. For ATR, it is well-known that the effecting thickness for p-polarized light is nearly twice that for s-polarized light at a 45° incident angle. This factor of two in the effective thickness is directly reflected in the spectral band intensities.

This applications note describes a quick test to experimentally distinguish the two perpendicular positions, generally marked ‘0’ and ‘90’ on the polarizer mount, using ATR spectroscopy.

EXPERIMENTAL

All spectra were collected using the Horizon, a fixed 45° incident angle multiple reflection ATR accessory, and a wire grid polarizer (KRS-5 substrate) installed in a commercial FT-IR spectrometer. The spectrometer was set for 16 scans at 8 cm^{-1} resolution.

The polarizer indicator was set to '90' and the background spectrum was collected. The Horizon trough was filled with water and the sample spectrum was calculated. The polarizer was then rotated 90° to the '0' setting to supply the other polarization and the data collection process was repeated.

RESULTS AND DISCUSSION

The resulting spectra are shown in Figure 2. As expected from the relative effective thicknesses at a 45° incident angle, one of the spectra has band intensities roughly twice that of the other. Hence the '0' setting on this polarizer provides p-polarized radiation to the sample.

This method can be used with practically any sample type and any ATR accessory to determine or verify the polarization. The only exception is for those accessories that scramble the incident polarization, such as those that utilize a rod-style ATR crystal.

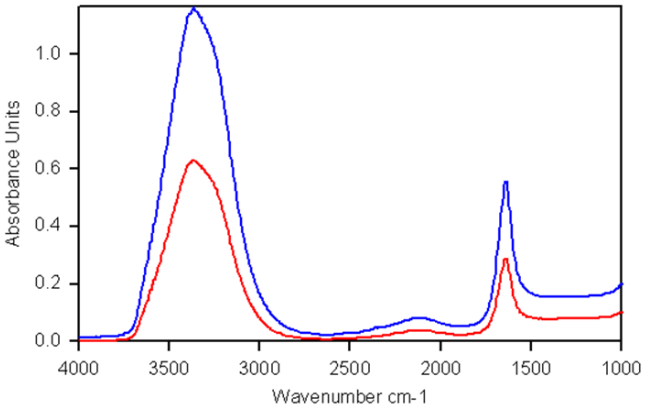

Figure 2. ATR Spectra of Water Recorded with the Polarizer Set to '90' (red) and '0' (blue).

REFERENCES

1. N.J. Harrick, *Internal Reflection Spectroscopy* (Wiley, NY, 1967).

HARRICK SCIENTIFIC PRODUCTS, INC.
141 Tompkins Avenue, 2nd Floor, PO Box 277
Pleasantville, New York 10570
www.harrricksci.com | info@harrricksci.com
International: 1-914-747-7202 | USA: 800-248-3847
Fax: 914-747-7209