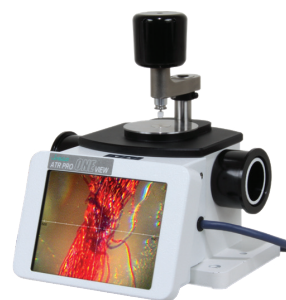


Minimizing the Effects of Water Vapor and Carbon Dioxide in IR Spectra

Introduction

Atmospheric water vapor and carbon dioxide (CO₂) strongly absorb in the infrared region and can interfere with the analysis and detection of weak sample peaks due to the additional peaks in the spectrum. In order to reduce the effect of the background peaks associated with H₂O and CO₂ it is important to maintain the concentration of water vapor and CO₂ at the same level when measuring both the background and sample. In this application note, we would like to introduce a couple measurement options to minimize the effects of CO₂ and water vapor, including “Shuttle Measurement” and “Purge and Vacuum”.



ATR PRO ONE
Spectrometers

Measurement Method

1. Shuttle Measurement

In this method the sample is placed in a sample shuttle (with background and sample positions) in the sample compartment, this allows background and sample measurements to be made without opening the sample compartment lid. Using a sample shuttle allows measurements to be made without the effect of changes in the atmosphere. Improved spectra are obtained with reduced background peaks from water vapor and CO₂ by making the measurements one after another in short time. This is an easy to use and effective method for transmission measurement.

2. Purge and Vacuum + Interval Measurement Program

This is useful for transmission measurement or for use with sampling accessories such as ATR or DRIFTS. Both purge and vacuum reduce the amount of water vapor and CO₂ in the instrument by removing them from the optical path. When using this method, the level of purge or evacuation has to be constantly maintained between background and sample measurements. Purge or vacuum are useful when using the Interval Measurement Program to provide continuous measurement of a process without the effects of changing water vapor or CO₂ levels. The data obtained using purge or vacuum under constant conditions allows much easier acquisition of spectra without the effects of vapor and CO₂.

Examples of Measurement

Measurement examples obtained with methods 1 and 2 above are introduced below.

Method 1 was used to measure a thin film of calcium stearate on the surface of a CaF_2 plate. Figure 1 shows the results of measurement with and without using the shuttle. When measuring peaks with low absorption such as in thin films, water vapor and CO_2 greatly influence the acquired spectrum. When using the shuttle, it can be observed that the effects of water vapor and carbon dioxide are significantly decreased.

Method 2 was used to measure a vinyl chloride film using a full vacuum system with an ATR accessory. The results of interval measurement are displayed in Figure 2. It can be observed that the data where the level of vacuum was not maintained shows the effects of water vapor and CO_2 . In this case, measurement usually has to be repeated after releasing the vacuum. During interval measurement, it is easy to continuously measure spectra without the effects of vapor and CO_2 using a full vacuum FTIR spectrometer.

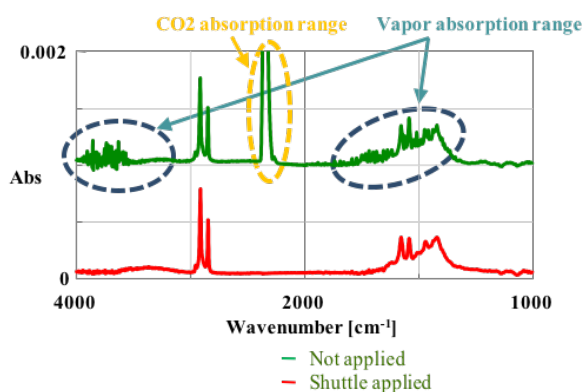


Figure 1. Shuttle measurement result

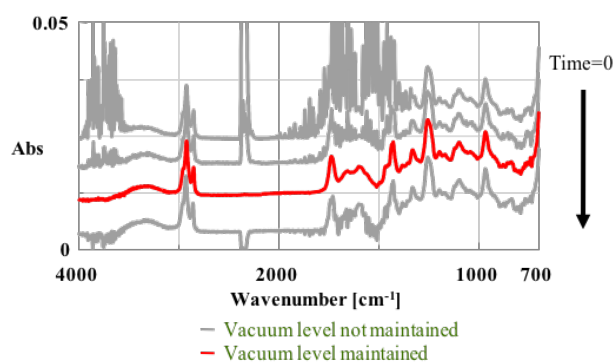


Figure 2. Full vacuum + interval measurement result