Why you should consider stability

The stability of an FTIR spectrometer is of utmost importance to obtain accurate and reliable results. Ideally, sensitive analytical lab instruments should be placed in an environment free of external disturbances.

However, in reality, external influences like vibration and temperature changes cannot be completely avoided.

How this affects FTIR spectrometers

An FTIR spectrometer consists of many sensitive optomechanical components like mirrors, windows and of course the beamsplitter.

Therefore, an external vibration source can produce artificial “peaks” in your spectra, resulting in an incorrect evaluation of the sample. As a result, it is very important to have a robust system that can easily withstand these external disturbances.

This product note demonstrates ALPHA II’s dominance in spectral stability compared to other compact FTIR spectrometers currently available in the market.

RockSolid is more than just the name of our patented interferometer design. It’s our statement for superior stability in our most compact FTIR spectrometer.

The problem with external disturbances

If you look into an everyday laboratory, you often see FTIR spectrometers standing in the vicinity of e-centrifuges, vortex or ultrasonic baths. Even if vibrations can be excluded, unexpected external disturbances are hardly avoidable.

These include, nearby construction works, load transport or even a vibrating mobile phone next to the FTIR spectrometer. Once such a disturbance is present, it could affect the result of the measurements.

Annotation

How we compared instruments

To provide meaningful test results we ensured:

- comparable instrument configuration;
  (e.g. compact format, DLaTGS detectors, of recent production date, accessories, etc.)

- identical and unbiased testing procedures;
  (e.g. same oven, bench, test environment and parameters like measurement time, etc.)

The examples presented in this product note clearly prove ALPHA II’s superior stability compared to other compact FTIR spectrometers in the market.
**Comparison #1: Baseline stability**

Baseline stability is the ability of an FTIR spectrometer to maintain consistent baseline measurements under the same conditions.

The comparative baseline measurements were performed under stable and identical conditions.

As seen from Figures 1 and 2, ALPHA II has a much better baseline stability with both the transmission and ATR sampling modules compared to a standard FTIR spectrometer.

This robustness is attributed to the RockSolid™ interferometer, which provides excellent stability unmatched by any competitor. It has a patented design that optically eliminates mirror tilt and mechanically prevents mirror shear.

**Comparison #2: Resistance to temperature fluctuations**

Since ALPHA II is so lightweight and portable, it can be easily used in a wide variety of locations and environmental conditions.

Therefore, it is important that ALPHA II’s performance remains consistent under varying environments, e.g., sudden temperature changes.

The single channel spectra of ALPHA II in Figure 3a show hardly any changes even in the presence of severe temperature fluctuations. This is a result of the temperature controlled DLaTGS detector’s high sensitivity, which provides high stability against external temperature influences.

In contrast, the standard FTIR spectrometer (Figure 3b) exhibits a gradual weakening signal and even shifts in wavenumber accuracy as temperature increases.

Figure 4 further solidifies ALPHA II’s excellent temperature stability. When the variance of a selected water vapor band was investigated, ALPHA II’s deviation is within 0.01 cm⁻¹. However, the standard spectrometer showed a significantly larger variance of the same water vapor band of more than 0.05 cm⁻¹.
Comparison #3: Susceptibility to shocks and vibration

Vibration is commonly found on benchtops in laboratories, induced by a running centrifuge or a vortex nearby. These vibrations may negatively influence the results of the FTIR measurements, especially if lower quality optomechanical components are used.

Figures 5a and 5b show the respective results with a centrifuge and vortex placed in between an ALPHA II and a standard FTIR spectrometer.

It is clearly seen that the baselines of the spectra from ALPHA II remained completely stable while erratic baselines were obtained with the standard spectrometer.

Another culprit of vibration can be our mobile phones, if left on the bench next to a FTIR spectrometer. An unexpected incoming call or notification could cause vibrations, thus ruining the FTIR measurement.

Comparison #4: Wavenumber stability

Wavenumber stability is the ability of the FTIR spectrometer to maintain its wavelength accuracy and wavelength precision.

In Figure 7b, the spectra from the standard FTIR spectrometer contain a lot of noise from uncompensated water vapor bands (indicated by yellow boxes). These resulted from poor wavelength stability due to laser variation.

In comparison, the spectra of ALPHA II (Figure 4a) do not show any uncompensated water vapor bands, which proves the unparalleled wavelength stability of the spectrometer. This is achieved by the high-precision laser that delivers best-in-class wavenumber accuracy.

Conclusion: The ALPHA offers maximum stability

With Bruker’s expertise and dedication to continuous improvement of our FTIR excellence and technology, we clearly demonstrated that ALPHA II is well above the standard and is the most stable, portable, entry-level FTIR product you can get!

- High spectral quality without artifacts
- Absolute baseline stability
- Reliable wavelength stability
- Resistant to shocks and vibration
- Insensitive to temperature fluctuations