

Not all FT-IR Spectrometers are the same: Sealing and Dessiccation

APPLICATION BRIEF

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Introduction

Infrared spectroscopy is a very sensitive analytical technique that can detect even small amounts of water vapor. Hence, even trace amounts of water vapor can be easily seen in an infrared spectrum, and may obscure important sample features.

Because of this, how an FT-IR system is sealed and desiccated is an important consideration in the selection of a spectrometer. This brief addresses important sealing and desiccation factors in the design of a FT-IR spectrometer.

Important Considerations

Some important factors in sealing and desiccation are the following:

- Occasional service requires opening a sealed system. Therefore, it is important to have a good seal between the baseplate and the walls
- Users may need to change beamsplitters and fill liquid nitrogen cooled detectors, so we must consider how easy is it for the user to access these locations and to restore a good seal.
- Even with a good seal, some methods of removing residual moisture are needed. This is even more important when changing a beamsplitter. Therefore, some form of desiccation is required and the performance of the desiccant will depend on its capacity.



Clear view port to see the self-indication desiccant

Circular access port for changing the beamsplitter

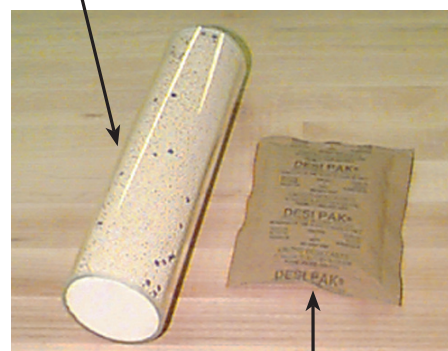
Figure 1. Easy Access and Effective Sealing

Varian's Advantages

- **Easy access and effective sealing when changing the beamsplitter on the Excalibur**
There is a circular access port for changing the beamsplitter that is sealed with a flexible plastic cover. There is also a viewing port to check the condition of the desiccant capacity and location within the spectrometer. Refer to Figure 1.
- **Varian's desiccant is among the largest in the industry and its location within the spectrometer ensures the highest performance.**

The performance of the desiccant will depend on its capacity and location within the spectrometer. The desiccant's capacity depends on the surface area and quantity of desiccant. The desiccant cartridge in Varian's Excalibur spectrometer is located closer to the beamsplitter than to the source because moisture can damage the beamsplitter and the elevated temperature of the source will reduce the carrying capacity of the desiccant. Figure 2 shows the Varian desiccant compared to that of another spectrometer manufacturer.

Varian's Desiccant Cartridge



Typical desiccant pack used by another spectrometer manufacturer

Figure 2. Varian's Desiccant Compared to Another Manufacturer's

Benefits to the User

A high performance, sealed and desiccated spectrometer enables the user to obtain infrared spectra with a very little of the baseline noise that would appear in the spectrum of a material if water vapour were present. This is particularly important when trying to detect small changes in the spectrum of a material that absorbs near the water absorbance peaks of 3300 cm^{-1} and 1660 cm^{-1} . Figure 3 shows the baseline region of a good sealed and desiccated FT-IR spectrometer. The noise in the baseline region near 3300 cm^{-1} and 1660 cm^{-1} is less than 0.0001 absorbance units. Figure 4 shows the ability to detect small spectral changes in the water region as a result of having good sealing and desiccation in the spectrometer.

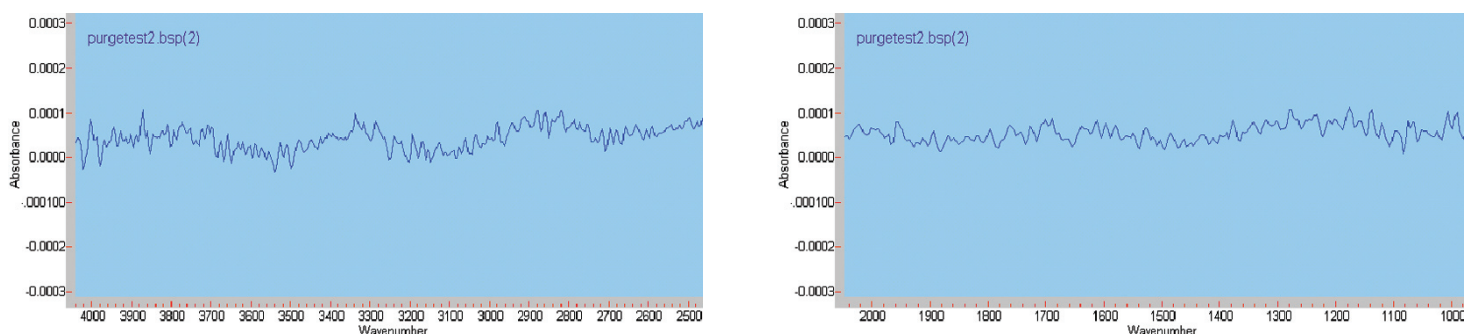


Figure 3. Low Noise in the Water - Absorbance Region means high sensitivity

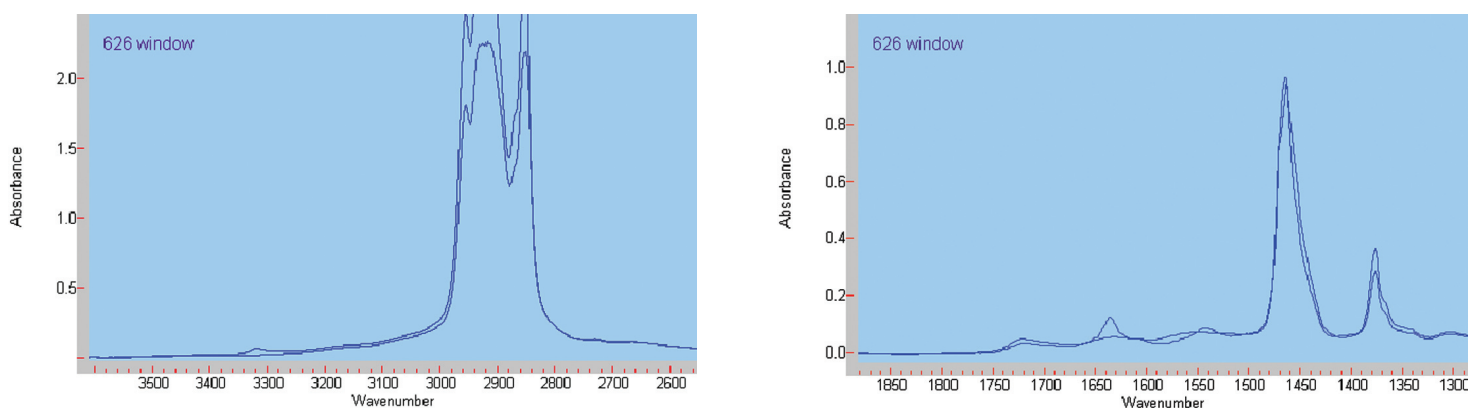


Figure 4. Note the small differences in the spectra in the $3300\text{--}3350\text{ cm}^{-1}$ region and the $1600\text{--}1660\text{ cm}^{-1}$ region.

Conclusion

The data presented in this application brief shows that not all spectrometers are alike. Indeed, the Varian Excalibur spectrometer possesses superior sealing and desiccation that translates into the ability to quantify spectral features close to the infrared absorption bands of water vapour.



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