MIR-FIR Spectroscopy in One Step: Wide Range Infrared Technology Realized the FT-IR Dream

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Introduction

Every spectroscopist dreams of measuring a wide spectral range with highest performance, but low configuration cost and easy operation. The measurement spectral ranges of FT-IR spectrometers are defined by their major optical components which are the source, beamsplitter and detector. For modern research FT-IR spectrometers software controlled switching of the sources and detectors is available as standard functionality. The bottleneck was the need of an automated beamsplitter changer demanding high development costs and technological complexity.

Recently Bruker implemented the VERTEX FM functionality for the VERTEX 70 and VERTEX 70v vacuum R&D spectrometers, that makes an old dream of the FT-IR spectroscopists a reality [1].

Instrumentation

In 2010 a 4 position automatic beamsplitter changer BMS-c was invented for the VERTEX 80v high-end research spectrometer [2]. As a unique and cost effective complement the ultra-wide range mid and far IR beamsplitter (T240/3) was introduced [3]. Together with the new ultra-wide range room temperature DLaTGS detector (D201/BD) [4] and the internal or external high power IR source the VERTEX FM functionality is assembled.

The complete mid and far IR spectral range can be covered in one measurement step without any gap and with no need to exchange any spectrometer optical components.

Additional Values of VERTEX FM Functionality

- Full mid and far IR spectrum in one go
- Enormous time saving due to just one single measurement
- Acquisition of the complete molecular vibrational spectral information
- No break of purge or vacuum conditions for optical component exchange
- No danger of touching and breakage of expensive and sensitive optical components
- No need for demanding robot like exchange device
- All optical components are insensitive to humidity

Application Examples

The extension of the mid IR towards the far IR spectral range below 400 cm\(^{-1}\) is of general interest for molecular vibrational analysis in various application areas. The spectra in figure 3 show a typical application example in the area of polymer analytics which demonstrates added value of the new VERTEX FM spectral range extension into the far IR region beyond 400 cm\(^{-1}\). The question regarding the type of contained filler material in the styrene-butadiene (SB) copolymer sample could be easily answered, because the characteristic absorption bands of the ammonium polyphosphate (APP) are not masked by absorption bands of SB like in the MIR region, and can therefore be clearly identified.

Far IR Application Areas

- Inorganic and metal organic chemistry
- Semiconductor development and research
- Studies on polymer filler material and color pigments
- Geologic and rock analysis
- Pharmaceutical fillers and active agent measurements
- Polymorphs differentiation
- Crystalinity, e.g. of explosives
- Product and material comparison
- Low temperature matrix isolation spectroscopy

Conclusion

The new and unique VERTEX FM functionality extends the VERTEX 70v and VERTEX 70 FT-IR spectrometers to the far IR and THz spectral range in an easy and efficient way. No exchange of optical components is required and the complete mid and far IR spectral range is accessible in one go without any gap. The VERTEX FM functionality makes the FT-IR dream a reality!

References