BRUKER

VERTEX

- VERTEX 70-70v Fourier Transform FIR-MIR Research Functionality

FT-IR

Innovation with Integrity

In 2014, Bruker introduced the world's first FT-IR spectrometer technology capable of covering the FIR/THz and MIR in a single scan, named VERTEX FM. No exchange of optical components or merging of spectra is needed to obtain data from the FIR/THz through the MIR. This innovative and unique development realized the dream of many spectroscopists since the introduction of FT-IR technique during the 70's of the last century. This new VERTEX FM functionality once again demonstrates Bruker's leadership and expertise in continuing to improve the use of infrared analysis and to meet new challenges in various application fields.

Additional Values of VERTEX FM

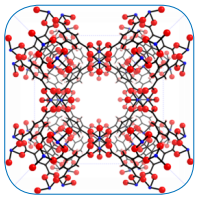
- Full mid and far IR spectrum in one go
- Enormous time savings due to just one single measurement
- Acquisition of the complete molecular vibrational spectral information
- No break of purge or vacuum conditions for optical component exchange
- No danger of touching or damaging expensive and sensitive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

VERTEX FM Main Application Fields

- Inorganic and organometallic chemistry
- Semiconductor development and research
- Studies on polymer filler material and color pigments
- Geological and rock analysis
- Pharmaceutical fillers and active agent measurements
- Polymorphs differentiation
- Crystallinity identification (e.g. plastics explosives)
- Product and material comparison
- Low temperature matrix isolation spectroscopy

"A dream comes true!"

Pharma



Organometallic chemistry

Polymer additives

Rock analysis

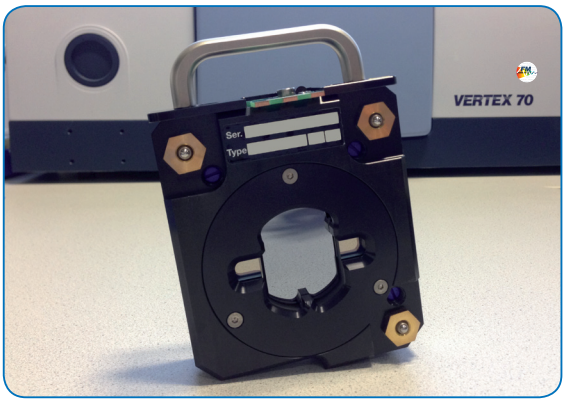
Plastic explosives

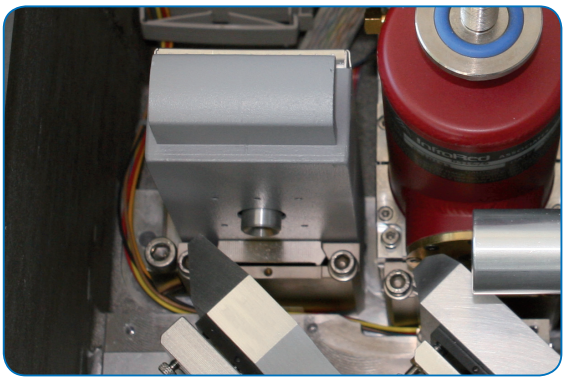
Semiconductor

MIR-FIR Spectral Range

The MIR spectral range is traditionally defined by a spectral range from 4000 cm^{-1} to 400 cm^{-1}, mainly because the materials of the applied optical components are limited to this range. For example, the lower edge of a standard KBr beamsplitter is 400 cm^{-1}.

With the emergence of interdisciplinary research, molecular vibrational spectroscopy can no more be isolated from molecular rotational spectroscopy, the detection of overtones, Fermi resonance and lattice vibrations.



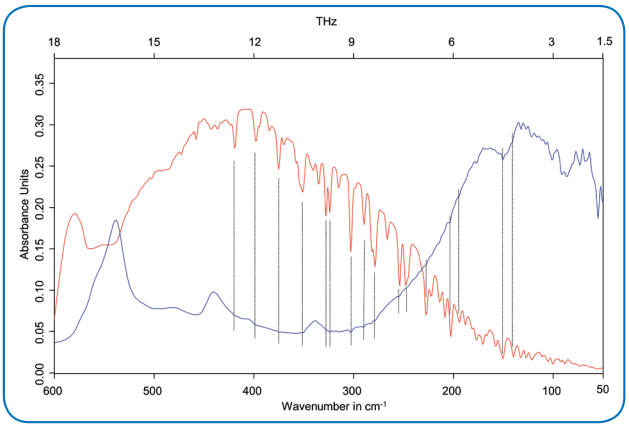


Images of the broad band beamsplitter and detector.

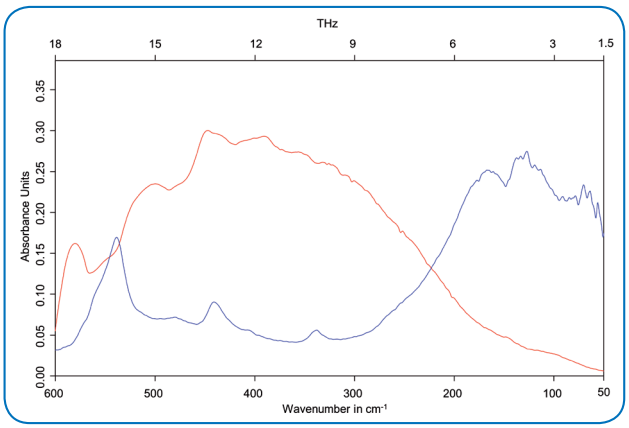
Therefore, a spectral range extension over the conventionally defined low MIR spectral range boundary is increasingly demanded. For example, for the characterization of organometallic complexes, semiconductor materials and polymer filler materials, the far IR spectral range must be collected in addition to the mid IR range. This means, the operator has to add or exchange different optical components to obtain data covering both spectral ranges spectral information. For example, using a VERTEX series spectrometer, the operator would have to replace the MIR KBr beamsplitter with a FIR multilayer or solid state beamsplitter, and insert the corresponding detector to measure in the far IR region from ca. 700 cm^{-1} down to 50 cm^{-1}. For the extension of the FIR/ THz spectral range down to 10 cm^{-1} or even 5 cm^{-1}, a dedicated external water cooled Hg arc lamp and room temperature or liquid He cooled detector are required. In other words, to obtain all the spectral information in MIR and FIR/THz spectral ranges, manually exchange or the use of mechanical devices for automated exchange was inevitable.

As a result, higher investment and maintenance costs as well as demanding user operation significantly limited research work. The time was ripe for a revolution in the FT-IR analysis technique.

Comparison of VERTEX 70 purge and vacuum systems equipped with the wide range beamsplitter in the far IR/THz region



Under excellent purge conditions, the VERTEX 70 can achieve 50 cm^{-1}.



The VERTEX 70v vacuum spectrometer provides virtually noise free FIR/THz spectra of a polymer composite. (red: single channel spectra; blue: absorbance spectra)

Optical Components

In 2012, Bruker's innovative engineering team developed a unique ultra-wide range mid and far IR beamsplitter (T240 / 3) for VERTEX 70 and VERTEX 70v FT-IR spectrometers (see Bruker product note PN T240). It covers the full mid and far IR spectral range from 6,000 – 10 cm^{-1} for all common IR measurement techniques like transmittance, reflectance and ATR without the need for manual or automatic beamsplitter exchange.

Then in 2014, Bruker introduced in a new extended range room temperature MIR-FIR/THz DLaTGS detector to cover the full IR range from above 12,000 cm^{-1} to ca. 20 cm^{-1} for the VERTEX instrument series (see Bruker product note PN D201). These new components combined with existing IR sources now make sample analyses of almost any sample in the FIR/THz and MIR quick and easy. For more information, see Bruker application note AN 118.

VERTEX FM Product Configuration

VERTEX FM exclusively available for the VERTEX 70 and VERTEX 70v spectrometers makes the FT-IR dream of most spectroscopists come true: Non-stop, no manual or automatic exchange of optical components, no need for subsequent spectra merge, covers entire MIR and FIR spectral range in one go. VERTEX FM can be customized in the following configuration packages:

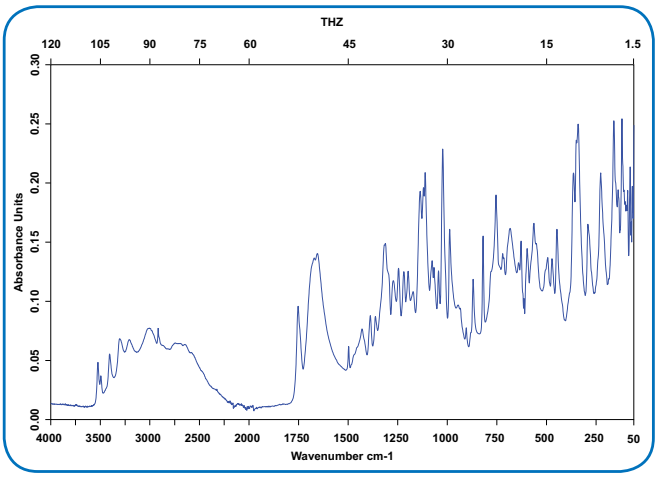
Part No.	VERTEX 70	VERTEX 70v
W240/B	6,000 - 130 cm^{-1}	
W240/BD	6,000 - 80 cm^{-1}	
W240/BDV		6,000 - 50 cm^{-1}
with Q201/8V (Hg source)		4,500 - 20 cm^{-1}

For already installed VERTEX 70 and 70v vacuum systems, the VERTEX FM functionality can be readily added.

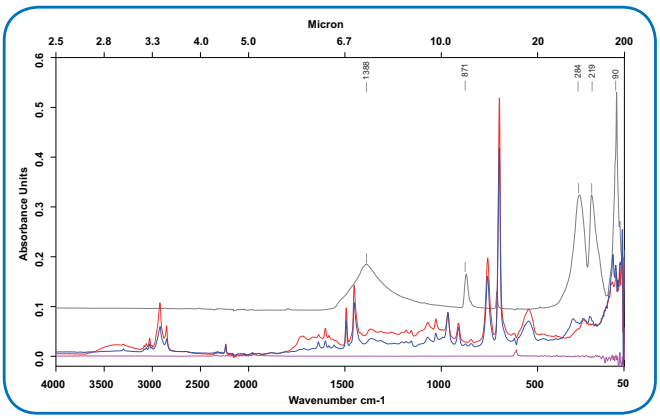
VERTEX FM ATR Library for the Entire MIR-FIR Spectral Range

Together with Bruker's VERTEX FM FIR/THz-MIR spectrometer, a smart VERTEX FM ATR library for the complete mid and far IR spectral range has been announced (see Bruker application note AN 123 and product note S39). It greatly simplifies the spectral search and identification process, especially in the FIR/THz region. This library is the first of its kind to extend the lower limit of available spectral range from 400 cm^{-1} down to 30 cm^{-1}. With the powerful combination of the Vertex FM and the new FM ATR library, new areas of research and development are readily accessible.

VERTEX FM Example Spectra:



An example spectrum of an active ingredient, ascorbic acid, collected with a VERTEX 70v / Platinum ATR combination from 4,000 cm^{-1} to 50 cm^{-1}.



"On the road" demonstration with VERTEX 70, VERTEX FM functionality and Platinum ATR unit of an ABS polymer with filler material containing $CaCO_3$, measured from 4,000 cm^{-1} to 50 cm^{-1} in 50 sec in one step.

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