



# VERTEX 70

● for routine to research applications



The VERTEX 70 provides the entry level of the Bruker VERTEX series of high performance FT-IR spectrometers for demanding analytical and R&D application. The innovative design results in PEAK flexibility and PEAK performance. The data acquisition of the fully digital FT-IR spectrometer is based on parallel running dual-channel delta-sigma ADC's with 24-bit dynamic range which are integrated into each detector. This advanced DigiTect™ technology prevents external signal disturbance and guarantees PEAK signal-to-noise ratio.

# ● VERTEX 70

## BRAIN: BRuker Artificial Intelligence Network

A network of intelligent functions such as recognition of sampling accessories and optical components, automatic set up and check of measurement parameters and the permanent online check of the spectrometer electronic and mechanical components makes FT-IR spectroscopy easy, fast and reliable. Specific software tools complete this outstanding functionality.

## Wide Spectral Range Extension

The VERTEX 70 can be optionally equipped with optical components to cover the entire spectral range  $15\text{cm}^{-1}$  to  $28,000\text{cm}^{-1}$  from the very far IR, through the mid and the near IR up to the visible and ultraviolet. With room temperature DLaTGS detectors, the most interesting spectral range from  $30\text{cm}^{-1}$  to  $10,000\text{cm}^{-1}$  is accessible. Due to the pre-aligned optical components and the cube corner mirror based permanently aligned RockSolid™ interferometer, changing spectral range is a very easy task. The beamsplitter is exchanged manually, which takes only seconds and requires no interferometer re-alignment. Two internal sources and detectors are computer controlled.

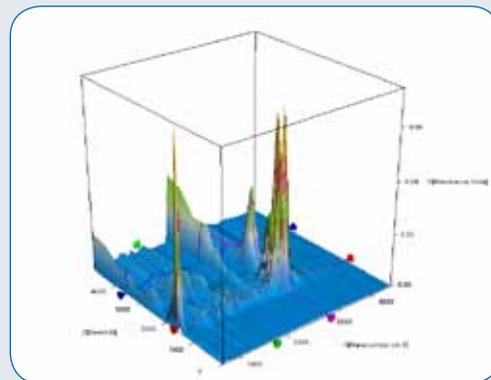
## Spectral Resolution

The standard spectral resolution of better than  $0.4\text{cm}^{-1}$  is suitable for most measurements of solids, liquids and low temperature crystalline samples. However, should the needs of the laboratory change, the spectral resolution capabilities can be upgraded to a non-apodized resolution of  $0.16\text{cm}^{-1}$  which is usually sufficient even for gaseous samples at ambient pressure, because the typical natural line width is greater than  $0.2\text{cm}^{-1}$ .

## Vacuum Optics

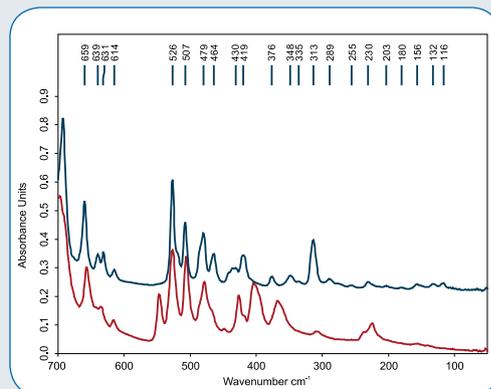
The VERTEX 70 is available under the model name VERTEX 70v with a fully evacuable optics bench. It is well accepted that vacuum optics provide pure IR spectra without residual moisture absorption which are of relevance for highly sensitive measurements in the mid and far IR spectral ranges. Details about the VERTEX vacuum spectrometer series are available in the related product descriptions.

## Rapid Scan Kinetics



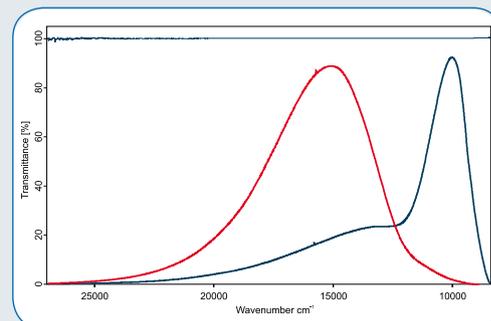
The OPUS 3D plot shows the thermal decomposition of a polymeric automobile undercoating material containing PVC. The spectra were measured on a VERTEX 70 coupled with thermal gravimetric analyser (TGA) with  $4\text{cm}^{-1}$  spectral resolution in time intervals of a few seconds.

## Far Infrared Spectral Range



Different metal oxide polyethylene (PE) pellet spectra measured with far IR optical components using the standard air cooled source, wide-band far IR beamsplitter and room temperature DLaTGS detector with PE-window at  $4\text{cm}^{-1}$  spectral resolution (spectra are offset for clarity).

## Visible Spectral Range



Background and 100%-line (blue curves) measured in the visible spectral range using  $8\text{cm}^{-1}$  resolution, 30 sec measurement time, 2mm diameter aperture with tungsten source, visible beamsplitter and Si-diode detector. Using an optical low path filter, the short wavelength efficiency (red curve) is significantly improved.

## • Features

### Ease of Use

The innovative optics design results in the most flexible and expandable FT-IR spectrometer available. With an easily maintained, sealed and desiccated optics bench, HIGHEST sensitivity in the mid- and near-IR regions is obtained on a spectrometer requiring no purge gas or cooling water. Automatic sample compartment shutters make it possible to use the sample compartment without windows, offering improved throughput and transmittance accuracy, e.g. for the measurements of optical components. The optional sample compartment telescope window inserts eliminate the purge wait time for the measurement of liquids, films or pellets especially in the far IR spectral range. Sampling accessories are mounted and pre-aligned on Bruker's Quick-Lock™ baseplate for fast, easy and reproducible exchange. Immediately after the sampling accessory is inserted, it is automatically recognized by the IntelliSense™ coding.

### ACR: Automatic Component Recognition

The sources, detectors and beamsplitters on the VERTEX 70 are electronically coded to be recognized by the instrument and the experimental parameters are reconfigured immediately. The user doesn't need to know which parameter set to load; it's all done automatically. In addition, if two components are installed which conflict, the VERTEX 70 will recognize this, inform you about the mismatch and offer you an alternative solution. The software is even able to propose optical components for the spectral range of interest.

- Sealed and desiccated optics bench, optionally purgeable
- RockSolid™ cube corner mirror based interferometer
- Up to 5 exit and up to 2 input beam ports remotely selectable
- Options for automated internal dual sources and dual detectors
- Automatic sample compartment shutters optional
- Easy beamsplitter exchange with permanent interferometer alignment
- Near IR, visible/UV and far IR/THz spectral range extensions
- Highest sensitivity due to parallel dual channel 24-bit dynamic range ADC's
- **BR**uiker **Artificial Intelligence Network (BRAIN)** technology
- Recognition of measurement accessories and optical components
- Rapid Scan, Slow Scan and Step Scan options for modulation and time resolved spectroscopy (TRS)
- Complete and integrated OPUS™ operation and evaluation software
- Availability of vacuum optics bench system VERTEX 70v



Opening the top cover provides easy access to the internal components, sources, storage area and tools.



Beamsplitters are easy to exchange and can be stored inside the optics bench.



Internal detectors, such as the Digi-Tect™ detectors, can be exchanged easily and reproducibly by the user.



70, PMA 50 module and HYPERION 2000 IR Microscope

### Source Options

Up to two internal and two external sources are remotely selectable. Exchange of the internal source does not require breaking the instrument optics sealing or purge. The standard far-, mid- and near-IR sources are permanently operated at an optimized and constant temperature providing the best signal to noise ratio without the need for any stabilization wait time. For the extreme far IR or terahertz spectral range down to  $15\text{cm}^{-1}$  or ca.  $0.5\text{THz}$  a water cooled high temperature Hg-arc source can be mounted at one of the external input ports. Using the right side input, the source radiation is directed through the aperture and filter wheel of the instrument which is an important functionality e.g. in case the exact wavelength of quantum cascade laser (QCL) sources need to be measured.

### DigiTect™ Detector System

Many different types of detectors are available for the VERTEX 70 FT-IR spectrometer which are based on the DigiTect™ technology. The detector housing integrates the preamplifier and the fast 24-bit parallel dual channel ADC. Photo diode type detectors feature a computer selectable preamplifier gain, providing excellent spectral detectivity at all light levels. The precise dovetail mounting enables easy detector exchange. For utmost sensitivity in the far IR or THz spectral range a liquid He cooled bolometer detector can be externally mounted and remotely selected.

### Plug & Play: easy set up

All over the world, no matter where you are, plug in the power and Ethernet connection, and the VERTEX 70 is ready for operation. The auto switching power supply and the Ethernet connection to the computer, or the local network, ensure this exceptional plug & play functionality. The Ethernet connectivity of the VERTEX 70 also permits control of the spectrometer via your intranet or the World Wide Web. The VERTEX 70 is the first high performance FT-IR spectrometer offering this extraordinary usability.



The detector compartment accommodates up to two room temperature or liquid  $\text{N}_2$  cooled detectors.

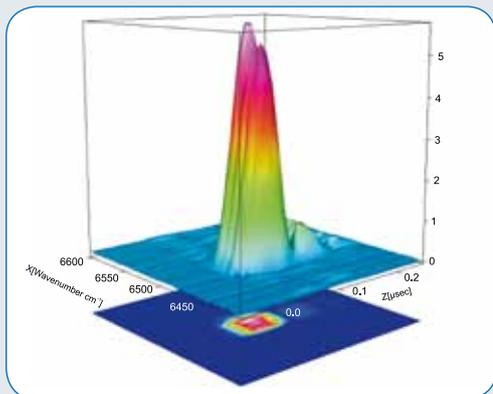


The large sample compartment accommodates virtually any FT-IR sampling accessory.



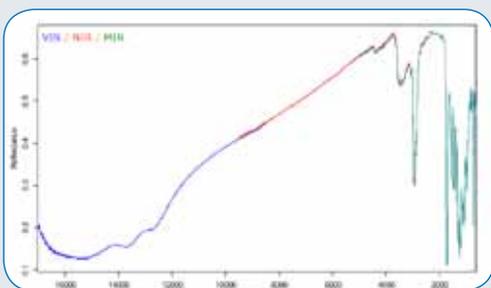
Many external accessories, such as the TGA module, can be coupled to the VERTEX 70.

## Step Scan TRS



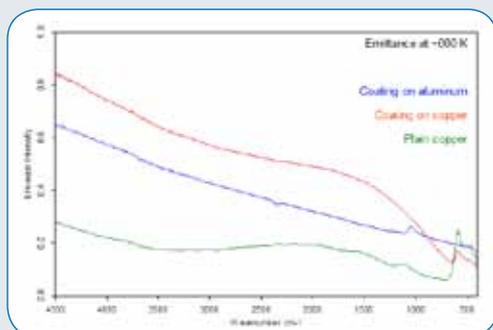
The OPUS 3D plot shows 10nsec time resolved emission kinetics of the switch-on of a NIR laser LED at  $4\text{cm}^{-1}$  spectral resolution. The data were acquired with a KBr beamsplitter and a DC-coupled photovoltaic MCT detector connected to a 100 MHz transient recorder.

## Hemispherical Reflectance



Integrating spheres allow measurement of the total hemispherical reflectance and diffuse hemispherical reflectance of rough surfaces. From such data the thermal emittance can be derived which is of particular interest for solar absorber coatings. The above spectrum of a green painted metal surface was measured by using a gold coated sphere. The perfect fit of three different spectral ranges from ca.  $17,000\text{cm}^{-1}$  to  $600\text{cm}^{-1}$  was achieved by automatic switching of two sources, manual exchange of two different types of beamsplitter as well as auto-switching of two detectors.

## Emission Studies



Emission measurements at higher than room temperatures are e.g. of interest for the characterization of absorber material used for solar power plants. The above spectra show coated and non-coated metal surfaces measured at ca. 600K using the emittance adaptor A540 mounted at one of the input beam ports of the VERTEX 70 and the standard room temperature detector.

# External Accessories

## for Advanced Applications

The VERTEX 70 offers an extensive line of sampling accessories for the internal sample compartment for transmission, ATR, specular, diffuse reflectance and additional types of measurements. Certain applications, however, need to be carried out using accessories that can only be mounted externally, e.g. for space reasons or to keep the internal compartment free for more routine measurements. The VERTEX 70 has the flexibility in its optical layout to couple multiple external accessories, such as the RAM II FT-Raman module, a Thermo Gravimetric Analysis (TGA) system, the HTS-XT high throughput screening unit, PMA 50 photoelastic modulator accessory or HYPERION™ series FT-IR microscopes. Using this combination of internal as well as external accessories means that the VERTEX 70 has the power to deal with almost any analytical problem amenable to FT-IR analysis.

## FT-IR Microscopy

Featuring full automation, infrared chemical imaging, crystal-clear sample viewing and a wide variety of IR and visible objectives, the HYPERION™ series provides you with everything needed to conduct the most sensitive micro-analysis easily and efficiently. The system allows upgrade to the fully automated HYPERION 2000 or the HYPERION 3000 hyperspectral imaging microscope with integrated Focal-Plane-Array (FPA) and single element detectors.

## FT-Raman Module

RAM II is an add-on module that combines fast and easy sample handling and the excellent suppression of fluorescence offered by FT-Raman. Switching between the infrared and Raman configurations are achieved through software control. An optional FT-Raman microscope can be coupled to the RAM II module and at the same time with the SENTERRA dispersive Raman microscope.



VERTEX 70 with RAM II module

### Photo-Luminescence Module

In a comparable design the PL II Photo-Luminescence module is available. It allows the analysis of e.g. compound semiconductor material at room or low temperatures. The PL II module is available either with visible (532nm) or near infrared (1064nm) internal excitation lasers. Furthermore, an optional external laser input port offers the usage of customer supplied laser sources.



PMA module

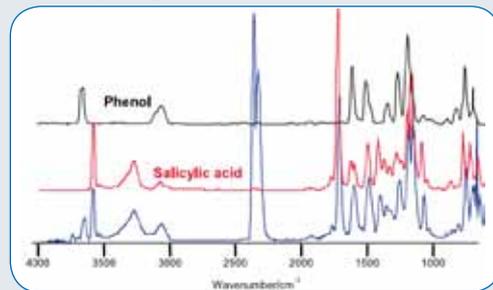
### Polarisation Modulation Accessory

With new electronics and use of the delta sigma ADC technology the VERTEX 70 offers true dual channel data acquisition. This provides outstanding performance for double modulation techniques utilising a Photoelastic Modulator (PEM), such as IR Reflection Absorption Spectroscopy (PM-IRRAS) for measuring very thin films in Linear Dichroism (LD) of ordered samples and Vibrational Circular Dichroism (VCD) of optically active samples.

### Hyphenated techniques

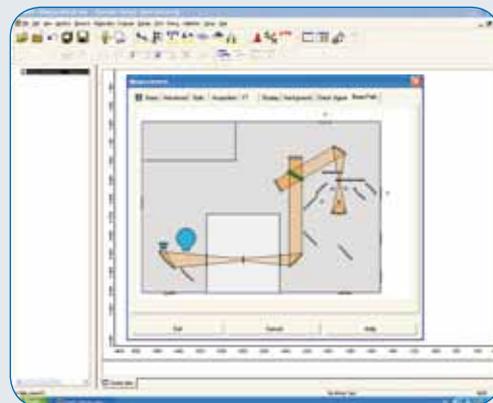
The coupling of the VERTEX 70 FT-IR spectrometer with a Thermogravimetric Analysis (TGA) system or Gas Chromatograph (GC) provides substantial additional information. For example the identification of gases released directly from the sample during a TGA run can not be performed just by thermal analysis. For that purpose the coupling with FT-IR is the ideal solution. Similarly GC is also a widely used technique in the field of chemical analysis because it is one of the most powerful separation techniques. However, particularly for fractions with many isomeric compounds the individual molecular characterization is difficult if not impossible by the GC retention times. Again the coupling with FT-IR spectroscopy is an ideal method for on-line sample identification.

### TGA coupling



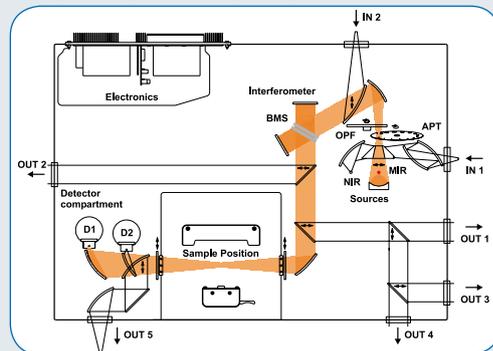
The above result shows the thermal decomposition of acetylsalicylic acid in an ASPIRIN® tablet at a temperature of 345°C versus reference spectra of salicylic acid and phenol from a digital spectral reference library. The example demonstrates that a TGA-FT-IR coupling is well suited to follow the complete decomposition steps of a pharmaceutical compound.

### Beam Path Selection



Easy beam path selection is available from the VERTEX 70 measurement software within OPUS. Just click on the required source, detector or available external beam port.

### Multiple input/output ports



The VERTEX 70 offers outstanding flexibility. Four beam exit ports on the right, front and left side, two beam input ports on the right and rear side and one front detector port are available. This allows for e.g. simultaneous connection of an emission accessory, the RAM II FT-Raman module, a fiber optics coupling unit, a bolometer detector and the HYPERION™ microscope.

## • Service and Support

Bruker is staffed by expert scientists and engineers that have an in-depth knowledge of instrumentation and applications. Our product specialists are available to assist you with method development either remotely or in your lab. FT-IR application scientists will assist you in the selection and use of sampling accessories, choice of optical components and software operation. We offer customized instruction and support packages to fit your needs.

Bruker FT-IR spectrometers are designed to provide years of dependable trouble-free operation, but should a problem occur a network of Bruker companies and representatives throughout the world are ready to respond promptly to your needs. Professional installations, comprehensive applications support as well as a high standard of post-delivery service are commitments Bruker Optics makes to each of its customers.



Technologies used are protected by one or more of the following patents:  
US 7034944; US 5923422; DE 19704598

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