

ADVANTEST[®]

**Terahertz Spectroscopic/Imaging
System**

TAS7500 Series

Rapid and non-destructive analysis of pharmaceutical samples



Pioneering the Future of Analysis — Compact Design with Advanced

The TAS7500 series is a multipurpose spectral imaging and analysis system capable of performing rapid analysis using the unique properties of terahertz (THz) waves. It acquires spectral data based on modes of low energy vibration and intermolecular interaction in the THz range, for spectroscopic analysis. Also, its high permeability and linearity offers a better solution, compared to near-infrared, for testing and analyzing the qualities in substances.

- Three different measurement modules - transmission, reflection, and ATR* - are available, allowing the user to select the spectroscopic analysis method best suited to the application
- Non-destructive imaging and analysis of tablet coating and internal structure
- High speed and outstanding reproducibility - Max. spectroscopy 8 ms/scan
- A flexible system built to handle all of your application needs

*: Attenuated Total Reflection (option)

TAS7500SP Spectroscopic Analysis

Terahertz Spectroscopic System

Three different measurement modes are available through a module exchange, enabling the system to perform flexible spectroscopic analysis

- Analysis of crystal polymorphism
- Analysis of hydration states
- Quantitative analysis of components
- Near-surface spectroscopic analysis of powders, tablets, etc.
- Analysis of the porosity and density of tablets



TAS7500IM Imaging Analysis

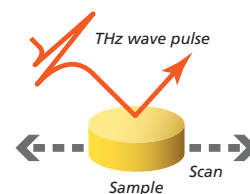
Terahertz Imaging System

Analyze and visually render thickness, density and the interface of tablets with external coatings

- Non-destructive tomographic analysis of thickness and density of tablets (multilayer tablets)
- Distribution measurement of density and thickness of tablets with external coatings
- Analysis of internal structure of dry coated tablets, etc.



Transmission module	Reflection module	ATR* module
For low absorption samples (tablets, etc.)	For measuring porosity and the structure of samples	For measuring powders and low absorption samples
 Tablets	 Multilayer tablets	 Powder Liquid



Functionality: TAS7500 Series Terahertz Spectroscopic/Imaging System

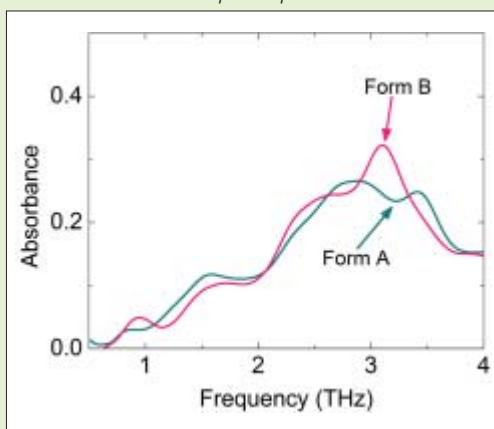
Example of spectroscopic analysis using the TAS7500SP

Analyzing crystal polymorphism in pharmaceutical products¹⁾

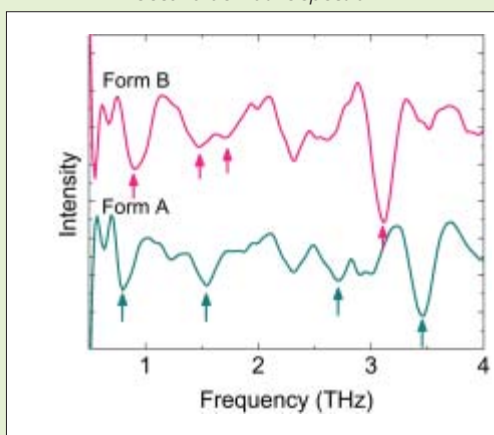
Absorption in the THz frequency range is sensitive to crystal lattice vibrations and intermolecular interactions in the API²⁾ of pharmaceutical products. As a result, the crystal polymorphism reflected in the THz spectral fingerprints can be analyzed. Analyzing crystal polymorphism in pharmaceuticals using powder X-ray analysis is time consuming and the crystal forms are difficult to characterize. With THz spectroscopy, however, crystal polymorphs (Form A, Form B) in complex compound A³⁾ can be analyzed in about 10 seconds. The top figure shows the THz spectral fingerprint of different crystal forms. The different crystal forms that were vague can be analyzed and made distinct by taking the second derivative (shown as figure below).

1): Source: Y.Ikeda, E.Kato, K.Terada et al., Chem. Pharm. Bull., 58 (2010) 76.
 Y.Ikeda, E.Kato, K.Terada et al., Proceedings of the 25th Annual Meeting of the Academy of Pharmaceutical Science and Technology, Japan (2010) 201
 2): Active Pharmaceutical Ingredient 3): Provided by Takeda Pharmaceutical Company Limited.

Absorption spectra



Second derivative spectra

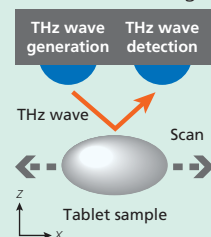


Example of imaging analysis using the TAS7500IM

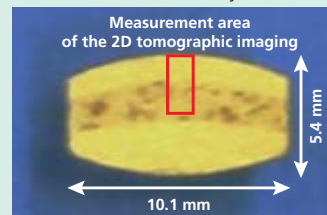
Non-destructive tomographic analysis of the density of tablets (multilayer tablets)

Tomographic imaging analysis can be done by analyzing the Time-of-Flight of THz wave pulses over a particular region of a tablet or over an entire tablet. If the interfaces present in the test material (tablet) have different refractive indexes, part of the THz pulses will be reflected as echo pulses. Non-destructive analysis of the coating thickness and density of materials can be done by analyzing the reflection intensity and lag time of the THz wave pulses that are reflected at these interfaces.

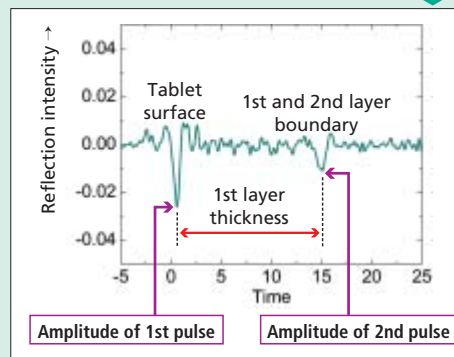
Measurement image



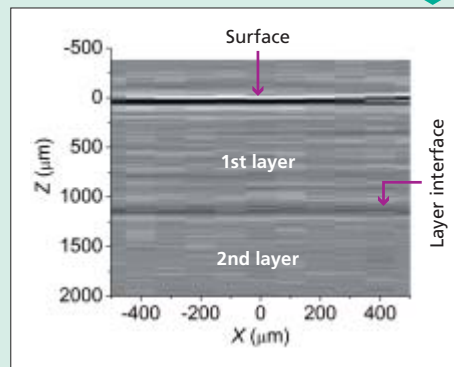
Cross-section of multilayer tablet



Reflection intensity waveform from multilayer tablet

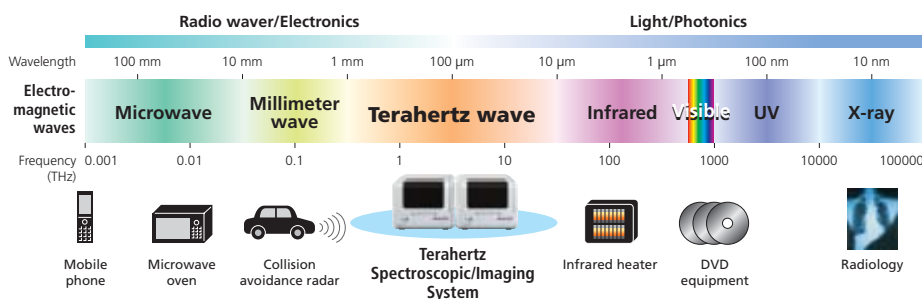


2D tomographic image



Terahertz waves

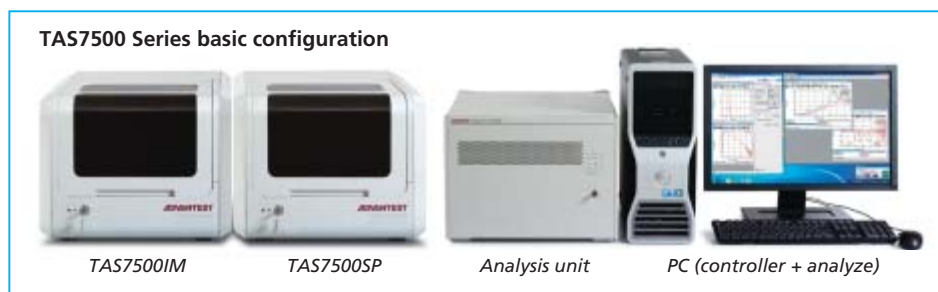
Terahertz waves, which possess an energy level between that of radio waves and light waves, have both the permeability of radio waves and linearity of light waves, and are capable of acquiring fingerprint spectra from organic compounds like pharmaceuticals based on molecular interactions in the THz frequency range. For the first time, imaging and analysis technology utilizing the unique qualities of terahertz waves to perform non-destructive imaging on pharmaceutical products is a reality.



Key Specifications

		TAS7500 Terahertz Spectroscopic/Imaging System	
		TAS7500SP Terahertz Spectroscopic System	TAS7500IM Terahertz Imaging System
Primary measurement applications		Spectroscopy (transmission/reflection/ATR ¹⁾ modes)	Tablet imaging and analysis
Analytical object		Pharmaceutical tablets, pharmaceutical products (powder, liquid), other reagents and chemical materials	
Specimen dimensions		Transmission/reflection mode: Diameter: 5 to 30 mm, Thickness: 10 mm or less ATR mode: Diameter: 5 mm or less (powder, liquid), 5 to 20 mm, Thickness: 10 mm or less (solid)	Imaging and analysis mode: Round tablet, Oval tablet, Oblong tablet Diameter: 5 to 20 mm or less, Thickness: 2.5 to 8.5 mm or less, Weight: 2 g or less (only in case of no engraved marks or score lines) ³⁾
Imaging function	Spatial resolution	—	0.3 mm or less (2 THz)
	Min. scanning resolution	—	0.05 mm
	Coating thickness measurement range	—	30 μm and higher
	Automatic measurement	—	Max.10 tablets on a dedicated cassette, measures automatically
Analysis/display function		Spectral display (transmittance, reflectance, ATR ¹⁾ , phase difference, absorbance, absorption coefficient, complex refractive index, complex permittivity), Time response display (electric field strength), Quantitative analysis ¹⁾	Point display (reflection intensity, reflection spectrum), Tomographic image display, 3D mapping display (thickness, surface reflectance, interface reflectance, FCSI*)
Measurement performance	Frequency range	0.1 to 4 THz ²⁾	
	Frequency accuracy	Max. ±10 GHz (1.4 THz) ²⁾	
	Frequency resolution	7.6 GHz	30.4 GHz
	Dynamic range	60 dB or higher (under peak frequency) ²⁾	
Throughput		8 ms/scan	<15 min (32 x 32 points, integrate 32 times)
Purge		Built-in dry air unit (external air supply required)	
Controller		Standard (OS: Windows7 Pro. 64 bits)	
Data file format		Binary format, JCAMP-DX, SPC, CSV	
General specifications	Usage environment	Temperature range: +10 to +30°C Relative humidity: 80% or less (no condensation)	
	Storage environment	Temperature range: -10 to +50°C Relative humidity: 80% or less (no condensation)	
	Power	Analysis unit: AC100V (100-120)/200V (220-240) ±10%, 50/60Hz, 160VA TAS7500SP: AC100V (100-120)/200V (220-240) ±10%, 50/60Hz, 150VA TAS7500IM: AC100V (100-120)/200V (220-240) ±10%, 50/60Hz, 180VA Does not include analysis PC	
	Size/weight	Analysis unit: Approx. 430 (W) x 540 (D) x 330 (H) mm/28 kg or less Measurement unit: Approx. 500 (W) x 490 (D) x 410 (H) mm/40 kg or less (TAS7500SP), 48 kg or less (TAS7500IM)	

1): Option 2): At temperatures of 23°C ± 5°C 3): Please contact us for analysis of tablets with engraved marks or score lines *: Film Coating Strength Index



Please refer to product manual for complete system specifications.
Specifications may change without notification.

ADVANTEST®

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