C101-E107B

Access to your success
SHIMADZU

UV-3600

Shimadzu
UV-VIS-NIR Spectrophotometer

High sensitivity, high resolution,
and an ultra-low stray-light level achieved
with the latest technology lead the way to new solutions.
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High Sensitivity

We developed the first UV-VIS-NIR spectrophotometer in the world with three detectors. These consist of a PMT (photomultiplier tube) for the ultraviolet and visible regions and an InGaAs detector and a cooled PbS detector for the near-infrared region. With conventional instruments, there is a drop in sensitivity in the crossover between the regions covered respectively by the PMT and the PbS detector. Using an InGaAs detector to cover this region, however, ensures high sensitivity across the entire measured wavelength range. The 1,500-nm noise level does not rise above 0.00003 Abs, which is the lowest level in the world.

High Resolution, Ultra-Low Stray-Light, and Wide Wavelength Range

Using a high-performance double monochromator makes it possible to attain an ultra-low stray-light level (0.00005% max. at 340 nm) with a high resolution (maximum resolution: 0.1 nm). The wide wavelength range of 185 to 3,300 nm enables measurement over the ultraviolet, visible, and near-infrared regions. This instrument can perform spectrophotometry for a variety of different fields.

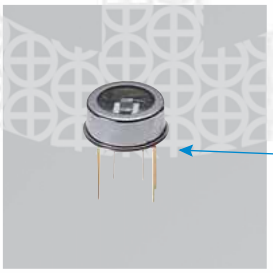
Wide Range of Optional Accessories

Using a large, multi-purpose sample compartment or an integrating sphere attachment enables the measurement of solid samples, and the ASR-series absolute specular reflectance attachments, for which measurement precision is assured, can be used to perform absolute specular reflectance measurement with a high level of precision. Also, a thermoelectrically temperature controlled cell holder or a microscopic cell holder can be installed and used to handle a wide range of measurement applications.

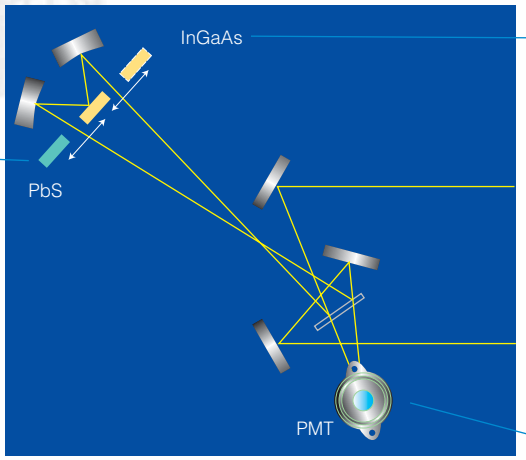
Contents

High Sensitivity

The UV-3600 can handle measurement with highly precise transmittance and reflectance, and uses three detectors to handle a range going from the ultraviolet region to the near-infrared region. The level of sensitivity for the near-infrared region has been increased significantly by using an InGaAs detector and a cooled PbS detector for this region. Spectra can be obtained for the entire range, from the ultraviolet region to the near-infrared region, with a high level of sensitivity and precision.



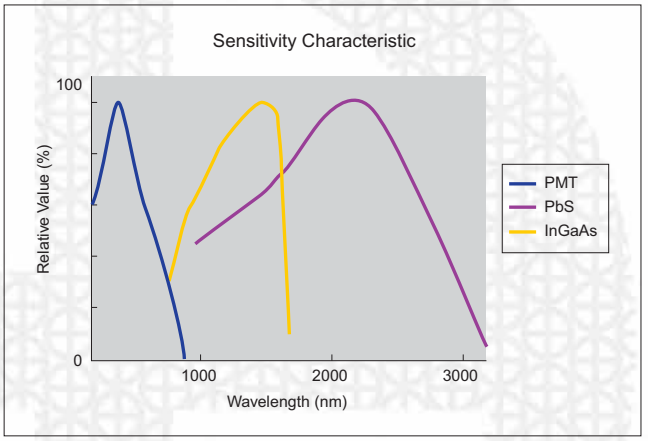
PbS detector



Optical system around detectors

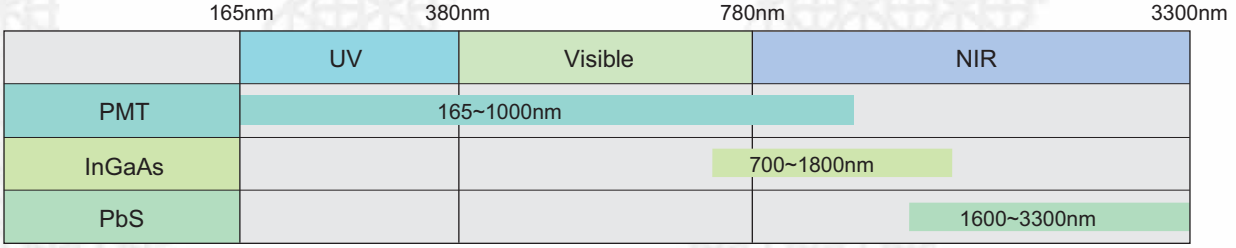
InGaAs detector

PMT detector



Until now, conventional spectrophotometers have used a PMT (photomultiplier tube) for the ultraviolet and visible region and a PbS detector for the near-infrared region. Neither detector, however, is very sensitive near the detector-switchover region. This prevents high sensitivity measurement in this range. The UV-3600 makes it possible to take high-sensitivity measurements in the switchover range by using an InGaAs detector.

Relationship between Detectors and Measurable Range

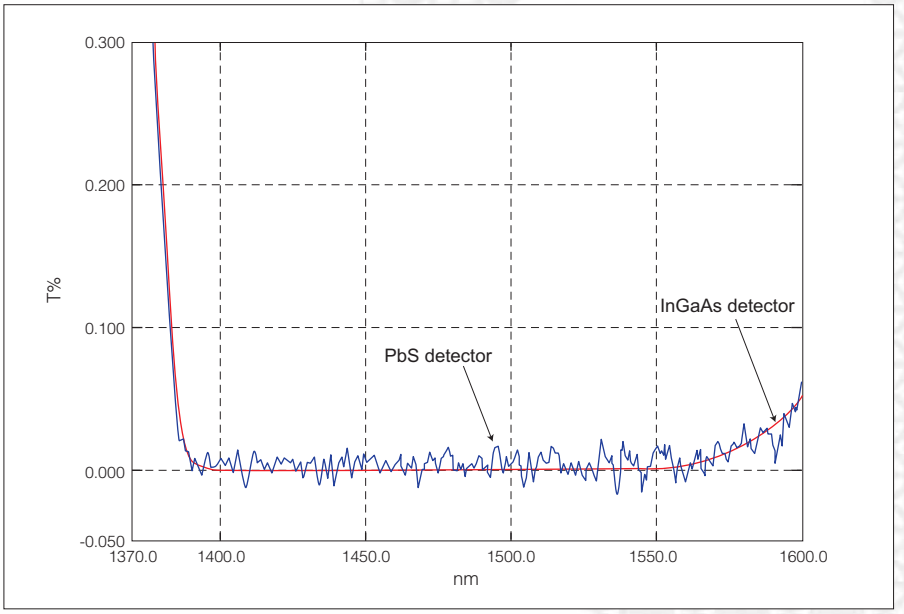


Switching between the photomultiplier tube and the InGaAs detector is possible in the range 700 to 1,000 nm (the default switchover wavelength is 830 nm).
Switching between the InGaAs detector and the PbS detector is possible in the range 1,600 to 1,800 nm (the default switchover wavelength is 1,650 nm).

Comparison between Two-Detectors and Three-Detectors Measurements

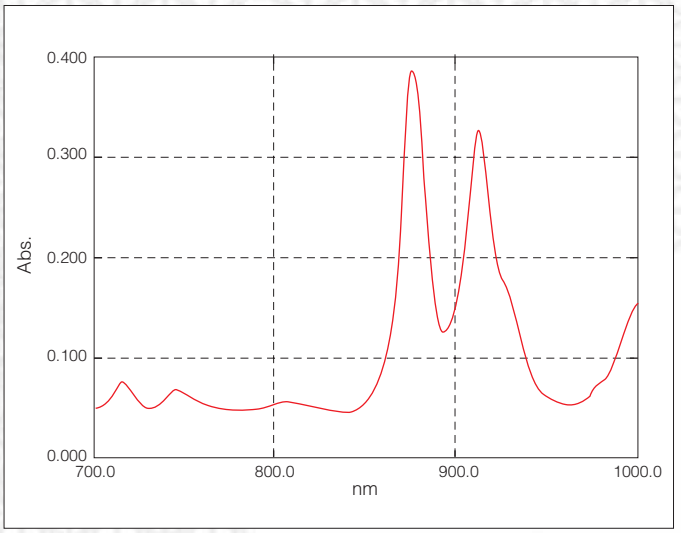
With the UV-3600, an InGaAs detector is used in addition to a PMT (photomultiplier tube) and a cooled PbS detector. In comparison with a conventional two-detector instrument (i.e., equipped with only a PMT and a PbS detector), the noise level in the InGaAs detector range (900 to 1,600 nm) is significantly reduced.

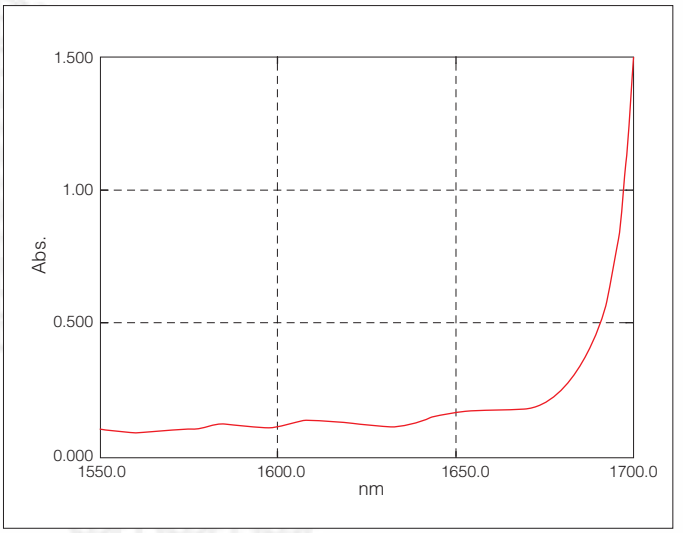
The figure on the right shows transmittance spectra for water measured with the UV-3600 (InGaAs detector and cooled PbS detector) and a conventional instrument (PbS detector) in the range 1,370 to 1,600 nm. It can be seen that the noise level is significantly less with the UV-3600. (A mesh filter is used on the reference-beam side to maintain balance with the sample-beam side.)



High-Accuracy Measurement with Minimized Detector Switchover Noise and Bump

Noise and bump caused by switching detectors is minimized to assure accurate measurement. Noise or bump is hardly observed even when using a transmission cell with a long optical path of 50 or 100 mm.



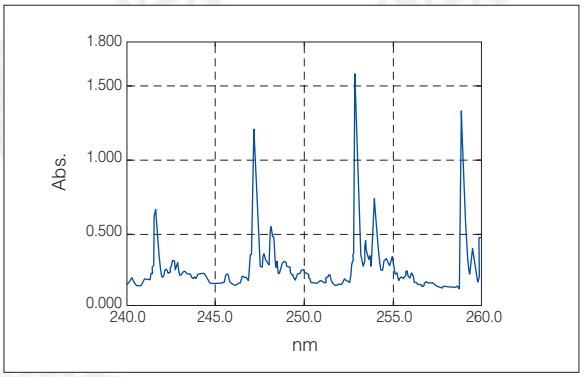


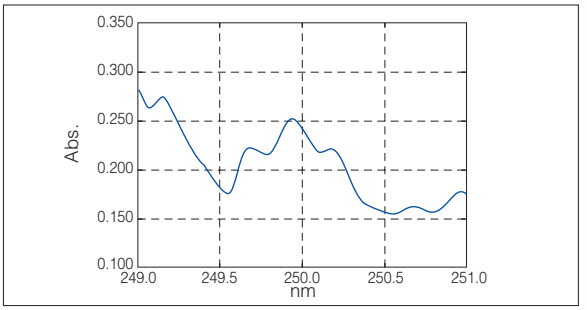
The figures above on the left and right are, respectively, transmittance spectra for ethylbenzene (obtained using a cell with an optical path of 100 mm) and cyclohexane (obtained using a cell with an optical path of 10 mm). There is hardly any level difference at the respective detector changeover wavelengths (870 and 1,650 nm).

High Resolution, Low Stray-Light

The UV-3600 is equipped with a high-performance, grating-grating double monochromator, and achieves a low stray-light level with high resolution. The wavelength range is

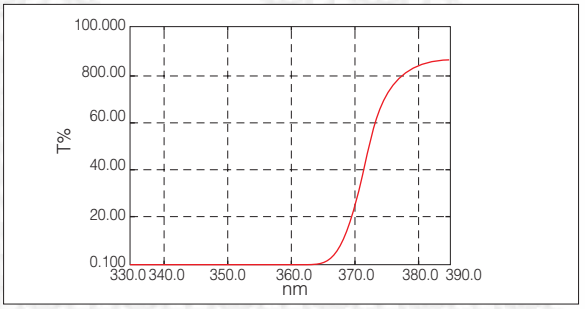
High-Resolution Spectra of Benzene Gas

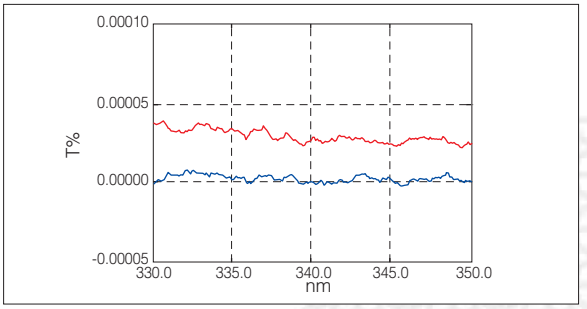




The spectrum shown on the left was obtained by enclosing benzene gas in a cell with an optical-path length of 10 mm and performing measurement. The spectral bandwidth is 0.1 nm. The triplet in the neighborhood of 250 nm (enlarged above) can be observed clearly. This instrument allows high-resolution spectra to be measured with little noise.

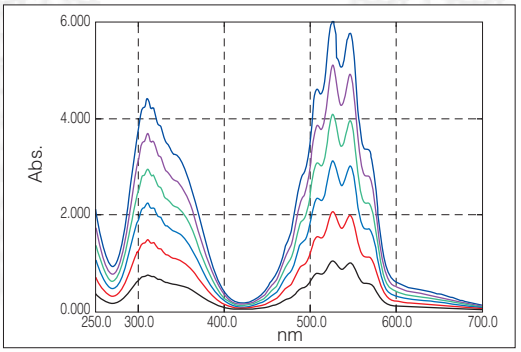
Ultra-Low Stray-Light Level of 0.00005% Max.(340nm)

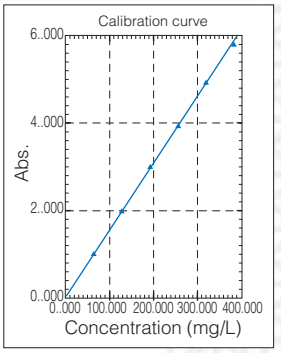




The figure above on the left is a spectrum for aqueous NaNO2 solution, and the figure on the right shows an enlarged view of the neighborhood of 340 nm. In the figure on the right, the red spectrum is for aqueous NaNO2 solution and the blue spectrum is the 0% line obtained when a shutter block is inserted on the sample-beam side. The UV-3600 achieves an ultra-low stray-light level of less than 0.00005% at 340 nm. (A mesh filter is used on the reference-beam side to maintain balance with the sample-beam side.)

Linearity Up To Absorbance Level 6





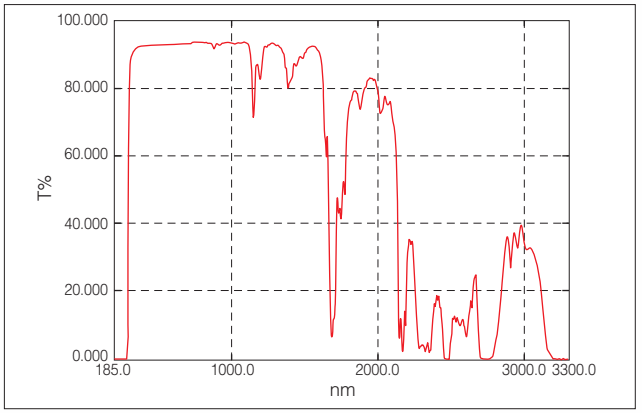
The figure on the far left shows spectra obtained by measuring aqueous $KMnO_4$ solution at six concentration levels. A mesh filter was inserted on the reference-beam side and a differential method was used to perform measurement up to absorbance level 6. Using negative absorbance enables measurement with little noise, even at high absorbance levels. The figure on the near left shows the calibration curve for aqueous $KMnO_4$ solution, and shows that linearity is maintained up to absorbance level 6.

Level, and Wide Wavelength Range

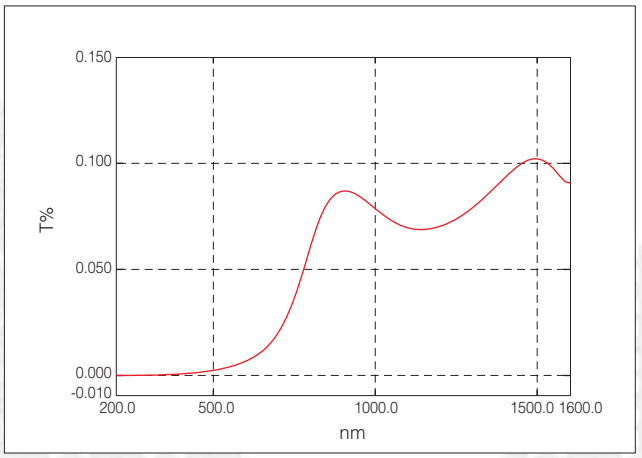
185 to 3,300 nm. This instrument can perform spectrometry for various types of sample, ranging from samples requiring a high resolution, such as gas, to high-concentration liquid samples.

Covers Wide Wavelength Range from Ultraviolet to Near-Infrared

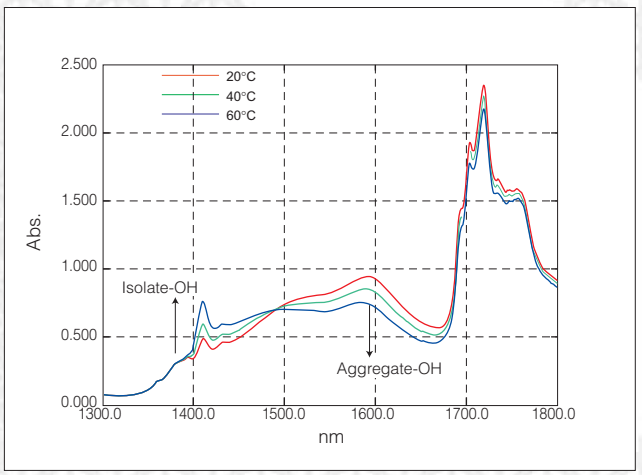
The wide wavelength range of 185 to 3,300 nm enables measurement over the ultraviolet, visible, and near-infrared regions. Spectra exhibiting little noise can also be obtained over a wide range of wavelengths.



The figure on the left shows a spectrum obtained by measuring toluene in the range 185 to 3,300 nm using a cell with an optical-path length of 2 mm. Spectra in the ultraviolet, visible, and near-infrared regions can be obtained.



The figure on the left shows the spectrum for a low-transmittance film on a silica wafer in the range 200 to 1,600 nm. Although the film is a special type of film with a transmittance of almost zero, it has been measured with high precision and little noise. (A mesh filter is used on the reference-beam side to maintain balance with the sample-beam side.)



Molecules of alcohol such as 1-butanol are thought to consist of a mixture of non-hydrogen-bonded isolates and aggregates formed through relatively weak hydrogen-bonding between OH groups.
As the temperature rises, the hydrogen-bonding becomes weaker and the aggregates separate into isolates.
The figure on the left shows near-infrared spectra for 1-butanol obtained at 20°C, 40°C, and 60°C. The peaks in the neighborhood of 1,400 nm that become larger as the temperature increases are OH peaks for a non-hydrogen-bonded isolate. The peaks in the neighborhood of 1,600 nm that become smaller as the temperature increases are OH peaks for a hydrogen-bonded aggregate.

UVProbe

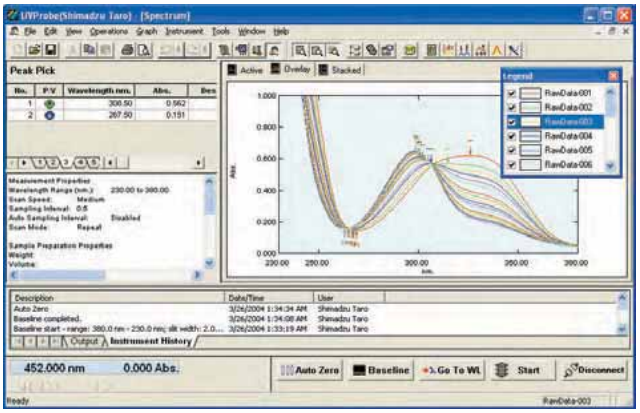
All-in-one Software

UVProbe is an all-in-one software package used to control the UV-3600 and incorporates the following four functions:

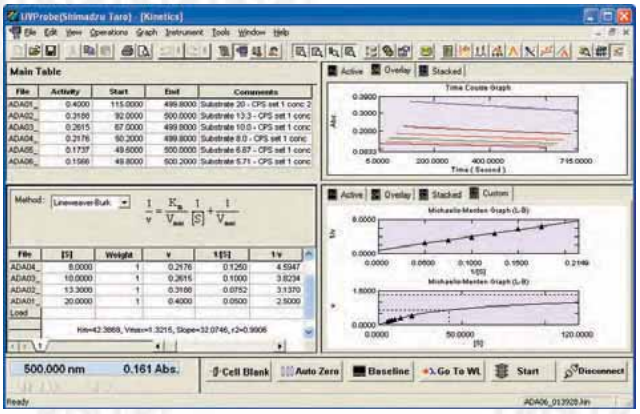
- Spectrum
- Photometric (Quantitation)
- Kinetics
- Report Generator

Each function can be easily operated with its dedicated screen. Included as standard are a wide variety of data processing such as peak/valley detection, area calculation, and others. Security features by which each user is limited to the use of specific functions, and an audit trail for the instrument and the data are all standard as well.

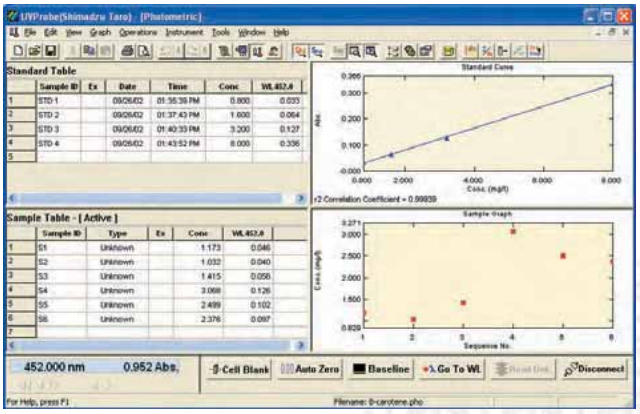
Spectrum



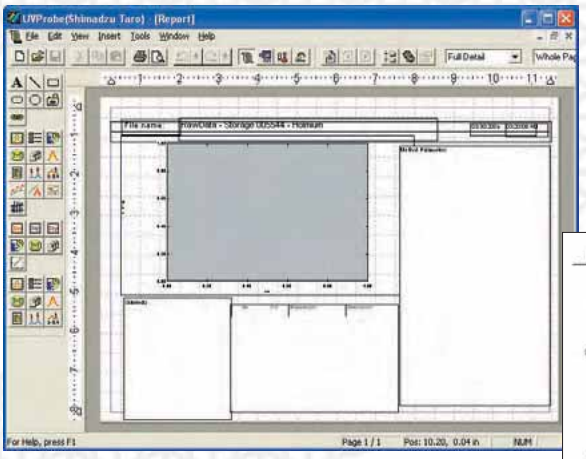
Kinetics



Photometric



Report Generator



The report generator gives you the freedom to arrange graphs, tables, etc. to suit your needs. The thickness and color of graph lines, as well as font size can be specified. Pasting labels on graphs and editing text is as easy as can be, allowing you to effectively print comments along with the analysis results.