Laser Raman Spectrometer

Features

- Compact & Flexible System Configuration
- High Resolution: < 0.3cm^{-1}
- Measurement down to 10cm^{-1}
- Confocal Optics for Microscope and Remote Probe
- Fully Automated 2D, 3D & 4D Raman Imaging
- Attachable to other Advanced Analytical Tools (e.g. AFM, XRD, SEM, etc.)
- Detect and Measure Impurities in Liquid as it is (Particle ID Detection)
- Modular Approach and Customized Solutions (UV-VIS-NIR etc.)

Laser Raman Spectrometer

STR series

STR series Laser Raman Spectrometer is a new generation high resolution Raman Spectrometer with a high sensitivity to measure even a very weak Raman scattering from materials

A basic system consists of a laser source, an imaging spectrometer, TE cooled CCD camera, an optical microscope with spatial resolution <1µm and/or a remote Raman probe. Based on the application, one can choose single/multiple excitation laser source (UV, Visible and near IR) that allows to scan a wide variety of samples including organic compounds. User-friendly, Window based control and data processing software make the operation of the spectrometer very easy. Configuration of the spectrometer is based on modular approach that gives ample flexibility for integration with other analytical tools such as AFM, XRD & SEM etc

STR series - Selectable Modules

Laser

DL 266	266nm	Deep UV	10, 20, 50mW
He-Cd	325 / 442nm	UV	15, 20, 35, 50mW 40, 50, 70mW
DL 532	532nm	VIS	50mW, 100mW, 1.5W, 3W
He-Ne	633nm	N-IR	17, 20, 35mW
DL 785	785nm	N-IR	100, 300, 500mW
DL 830	830nm	N-IR	150mW
DL 1064	1064nm	IR	500mW, 1W

Imaging Spectrograph

STR150	150mm Focal Length flat field : 25mm(W) X 10mm(H) Resolution: 1.1cm^{-1}/pixel
STR200/300	200 /300 Focal Length flat field: 30mm(W) X 14mm(H)
STR500/700	500 / 750mm Focal Length flat field: 25mm(W) X 14mm(H Resoluion: 0.6/0.4/0.3/0.2cm^{-1}/pixel

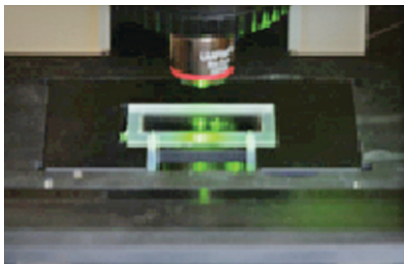
Cooled CCD Camera*

CCD	Front / Back illuminated type ultra sensitive TE cooled CCD
EMCCD	For fast data collection

*Please refer specificition sheet for details

Optical Microscope

ST-BX54/LV /Ti(INV)*	Confocal Raman optical microscope with 1µm spatial resolution,< 2µm axial using x100 objective lens
	Motorized entrance Raman optics assembly
	Halogen Light (ref/trans/epifluorescence)
	Objective lens x5, x10, x20, x40(UV), x50, x100
	CCD color video camera, XYZ stage
	Software controlled Laser power selection (1 to 100%)
Options	Line illumination optics to reduce laser damage in sample Motorized XY stage**, Z-axis auto focus motor, peizo XYZ stage and laser protection cover (class 1)

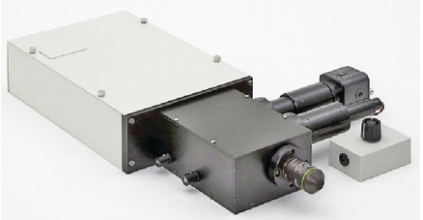


*M option: motorized revolver and halogen illuminator,
*P option (UV-PM, VIS-PM): Polarized Raman measurement, and observation,
**Step size: 0.1µm, maximum travel 3"X2", or 4"X3" /w Joystick

*Please consult us for additional specifications

Remote Raman Probe

RPM-xxx*	> 25mm working distance
	Spot size < 5µm
	Raman filter set is common for both optical microscope and remote Raman probe and is easily exchangeable to other laser lines. Please consult us for other working distance

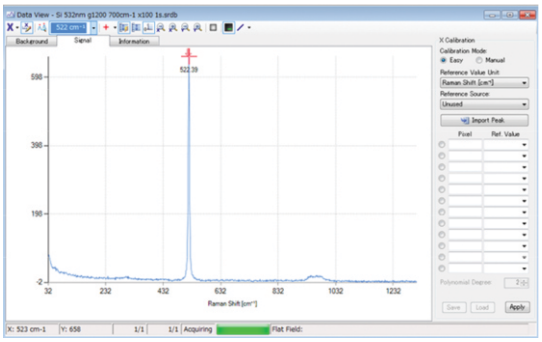


*Please specify laser source

STR series - Raman Data Collection & Mapping Software

STR Data Collection Software

Latest Windows based data collection software, which can control the grating angle, Raman shift and slit width for spectrograph. Furthermore, it can also control the exposure time and read out format for the cooled CCD camera. Measurement parameters can be saved in a configuration file and can be loaded easily. Cosmic ray reduction and file conversion (text, Grams SPC format) functions are also part of the software



AutoMap Software for Auto XYZ Scanning and 2D, 3D & 4D Imaging

This software acquires Raman spectra of specified XYZ coordinates in various configurations, from scanning X and Y while keeping Z fixed (and vice versa) to scanning XYZ. The same software can plot peak strength or area of the specific Raman shift and display the Raman image in 2D, 3D and 4D images

XY-Scanning, Z-Fixed

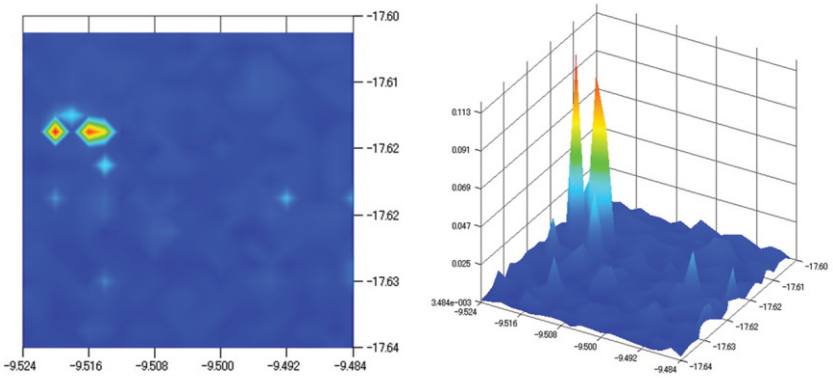


Fig 1 : Opal Slice

Data provided by K. Shinoda, Osaka City University

Confocal Depth Profile

Lower the focus point from the surface of the intervals of 1μm

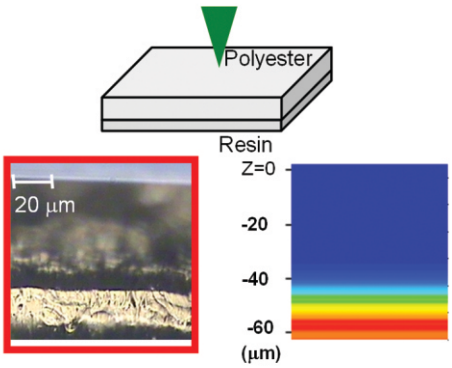


Fig 2 : Polyster/Resin Laminated Film

XYZ-Scanning and Raman Imaging

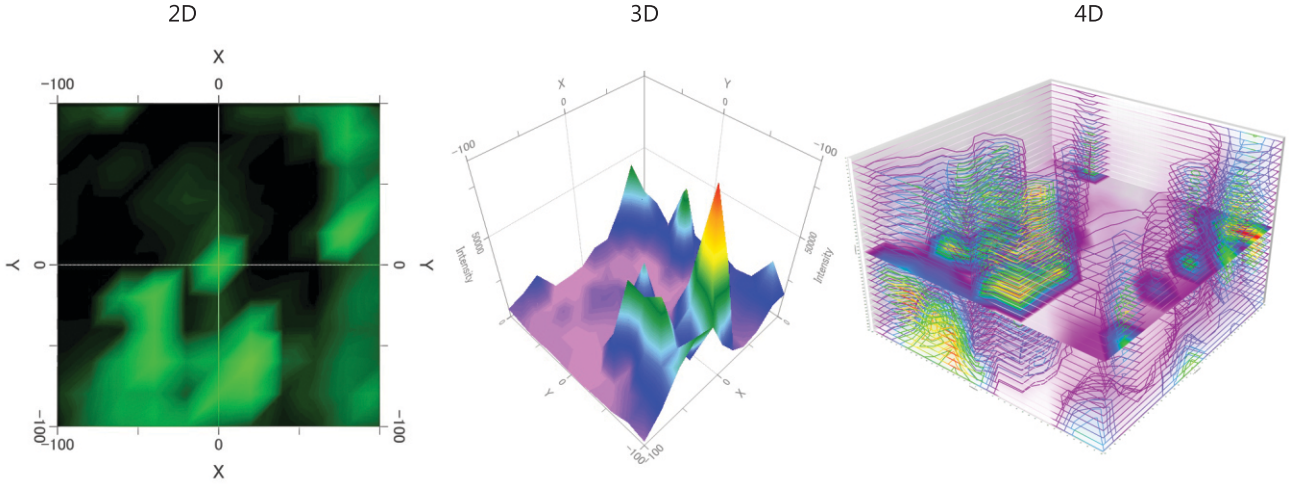


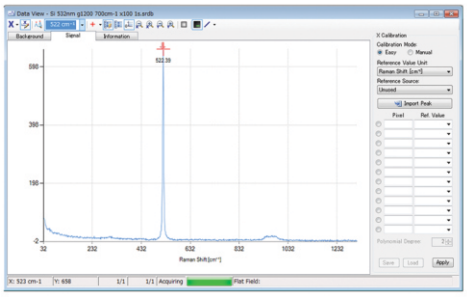
Fig 3 : 2D, 3D and 4D Imaging of Sulpur

Integration with standard Raman Data Processing, Application Examples

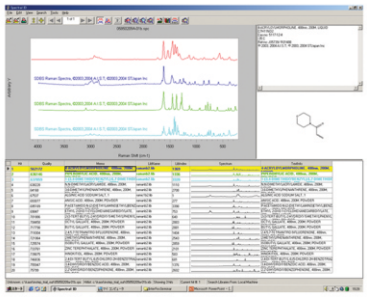
Data Processing Software Grams32/AITM*

STR Data Collection Software output can be smoothly processed with other standard software such as Grams32/AI™ a premier solution for visualizing, processing and managing spectroscopy data and with functions of operation of the differentiation and integration between spectra and curve fittings, de-convolution, etc. In addition, the following are also offered as optional software for the data analysis

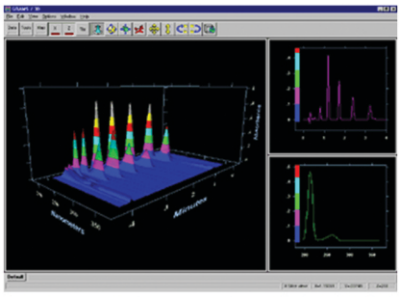
- **Spectral ID™** Spectral ID provides rapid searching of multiple format Raman spectral libraries. Libraries can be centrally hosted, managed and searched
- **Grams/3D™** GRAMS/3D adds real-time, interactive 3D graphic visualization to the extensive list of capabilities already included in GRAMS/AI. Unlike static 3D plotting and rendering packages, GRAMS/3D is a true real-time visualization software application that offers scientists an interactive tool to view all the information in multidimensional data sets



Data collection software



Identification of unknown material

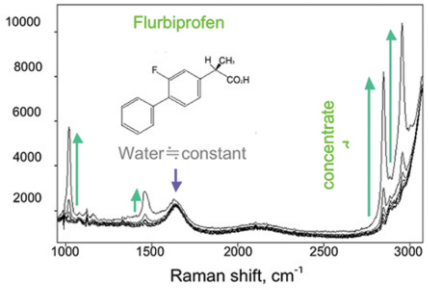


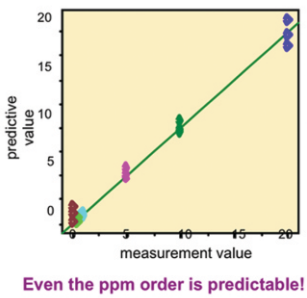
Displayed 3D image by Grams/3D

*by Thermo Scientific, USA

Multivariate Analysis Software PLSplus/IQTM*, PirouetteTM*

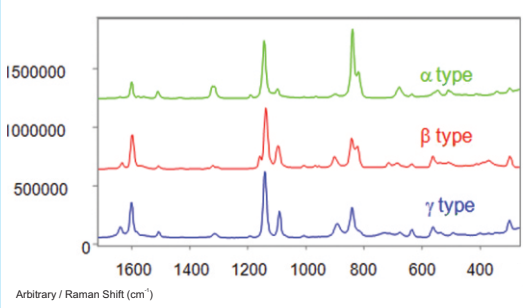
Quantitative analysis: This analysis is done by PLS method (Partial least squares regression) by constructing the model with the solution concentration and relative intensity of Raman spectra. Physical properties of the sample are estimated from the calibration data set



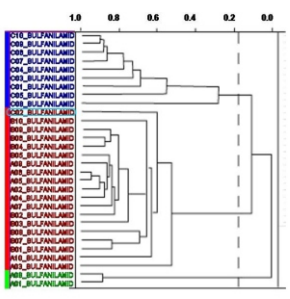


Even the ppm order is predictable!

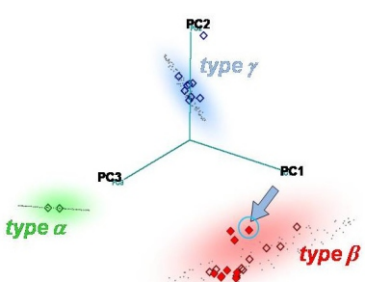
Polymorph Characterization (High Throughput Crystallization with 96 well plate): STR Data Collection Software output is smoothly combined with other software to automate crystallization data collection from micro well plates to quickly analyze and present meaningful information. The result is new levels of efficiency in high throughput crystallization (HTC) studies



Sulfanilamide Raman spectrum



SIMCA



HCA

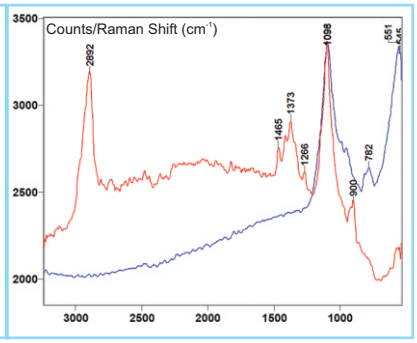
*by Infometrix Inc., USA

Auto Detection of Foreign Materials in Injected Liquid

This software can automatically detect the foreign material in liquid micro cell using image analysis (i.e., binarization processing) under the optical microscope with color CCD camera image

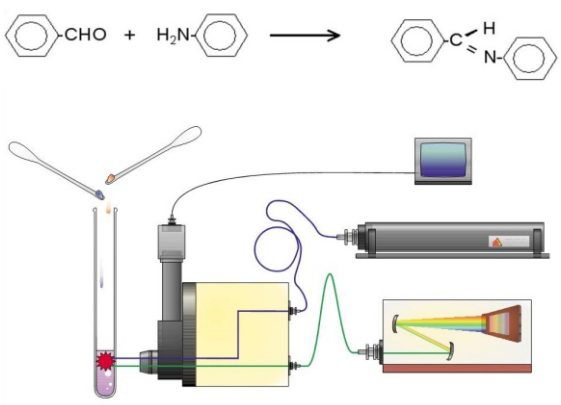
Automatic detection of solid foreign materials in liquid

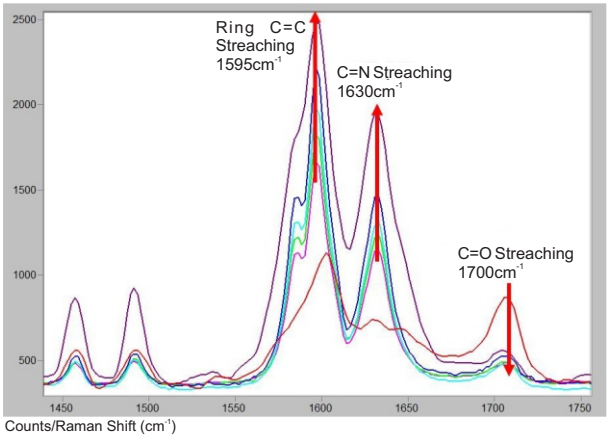
Photographic image and binarization image of foreign material



Process Monitoring by Remote Raman Probe System

Real time monitoring of Aminouracil reaction by time dependent Raman Spectroscopy, which shows increasing intensity of C=C (1559cm^{-1}) and C=N (1630cm^{-1}) at the expense of decreasing intensity of C=O (1700cm^{-1})

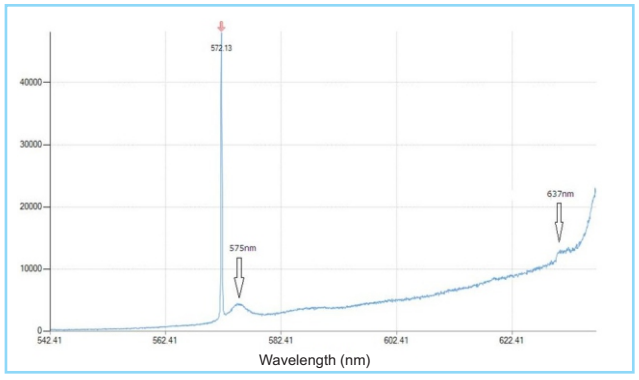




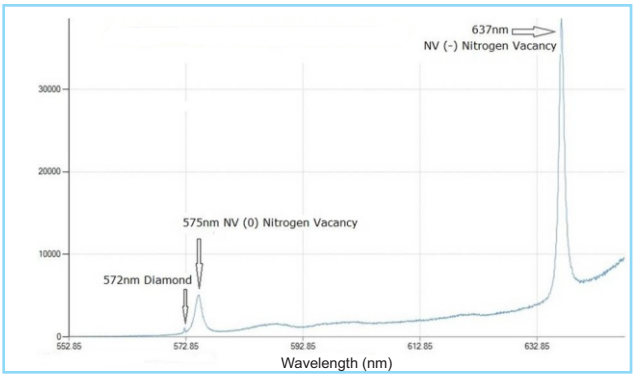
Time-dependent Raman spectra of imine formation at intervals of every 2 minutes

Photoluminescence and Optical Emission Spectroscopy

Our STR series Raman Spectrometer, standalone equipment, is equally capable of carrying out Photoluminescence (PL) and Optical Emission Spectroscopy studies. The spectra in left and right, below, show respectively the PL spectra of diamond taken at room temperature and at -100°C. The PL intensity of the nitrogen-vacancy point defects in diamond (i.e., NV(0) and NV(-)) increases drastically when diamond is cooled down to - 100°C



PL Spectra of diamond @ Room Temperature



PL Spectra of diamond @ - 100°C

Laser Raman Spectrometer

STR series

STR series - Specifications of Raman System

Laser*

DI266	He-Cd-A/B	DL/SF-488	DI532	HeNe633	DI785	DL 830	DL 1064
DPSS Deep UV 266nm 10, 20, 50mW	Gas Laser A: 325nm, (UV) 15, 20, 40, 50mW B: 442nm, (UV) 50, 70, 100mW	Diode Laser VIS 488nm 50mW, 1W	DPSS Nd-YAG VIS 532nm 50, 100, 500mW 1.5W, 3W	Diode/Gas IR 633nm 17, 35mW	Diode Near-IR 785nm 100, 300, 500mW	Air cooled diode Near IR 830nm 150mW	DPSS Nd-YAG Deep IR 1064nm 500mW, 1W

Standard items with the laser are 2m optical fiber and laser to fiber coupler, Laser base plate. Please consult us for additional specification *NIST Certificate (optional)

Imaging Spectrograph

	STR150-x	STR200-x	STR300-x	STR500-x	STR750-x
Focal Length	150mm, f/4	200mm, f/3.6	300mm, f/4	500mm, f/6.5	750mm, f/9.7
Resolution	1.1cm^{-1}/pixel*	0.6cm^{-1}/pixel**	0.4cm^{-1}/pixel**	0.3cm^{-1}/pixel**	0.2cm^{-1}/pixel**

Common items to the above are aberration corrected Czerny-Turner single spectrograph, 3 gratings (max. 9 gratings) for STR 300/500/750, and 2 gratings (max. 6 gratings) for STR 150/200, Window based computer with a data collection and processing software. Entrance slit: 10µm - 3.0mm, RS232C/USB, optical fiber 2m. scan repeatability <0.5cm^{-1}

Spectrum range: 200 - 2100nm, Raman shift: 5 - 5000cm^{-1}, Spectral resolution @532nm & 15µm CCD using 300g, 600g,1200g,*1800g, ** 2400g

x: number of gratings (300g, 600g, 1200g, 1800g, 2400g)

Cooled CCD camera

	316LDC-DD	iVac-FI	DU416A	InGaAs
Format	2000x256 pixels, 15x15µm	1650x200 pixels, 16x16µm	2000x256 pixels, 15x15µm	1024x1 pixel, 25 x 500µm
Range	200-1100nm (UV-NIR)	380-1100nm (VIS-NIR)	200-1050nm (UV-NIR)	0.6µm to 1.7µm
QE	>95%	>55%	>95%	>85%
Dark noise	0.1 e-/pixel/sec (TYP)	0.0028 e-/pixel/sec (TYP)	0.0006 e-/pixel/sec (TYP) @ maximum cooling	10.1K e-/pix/sec
Read noise	< 4e- RMS (TYP)	< 5.8e- RMS (TYP)	< 4e- RMS (TYP)	< 580 e- RMS (TYP)
TE cooling	-60°C	-60°C	-80°C (air cooled) -95°C (coolant@10°C , 0.75L/min)	-70°C / -90°C

CCD type F/UV:front illuminated (FI) /w UV coat, B/BV: back illuminated (BI,BI_eXcelon), BR-DD: BI deep depletion (DD), E: Open electrode
ADC 16 bit, wavelength range: 200-1100nm /w UV coat option

Raman Sampling accessories

Optical Microscope ST- BX54/LV/Ti(INV)*

Confocal Raman optical microscope with < 1 µm spatial resolution using x100 objective lens, Raman probe with Raman filter set, halogen light (ref/trans), Objective lens : x5, x10, x20, x40(UV), x50, x100, CCD color video camera, variable spot size up to 300 µm (WAC)

Remote Raman Probe-xxx***

>25 mm Working distance , Spot size < 5µm
Raman filter set**

Raman filter set is common for both optical microscope and remote Raman probe and is easily exchangeable.

*M option: motorized revolver and halogen illuminator, *P option: Polarized Raman measurement, and observation

** Please specify the excitation wavelength: 266, 325, 355, 442, 488, 514.5, 532, 633, 785nm

***Please consult us for additional specifications

Piezo XYZ stage

XY 200µm, Z 25µm stroke,
accuracy XY < 2nm, Z < 0.2nm

Options

Auto λ*

Auto exchange unit for the Laser line and Raman optics unit
Auto alignment function for 5 and more Laser lines and Raman optics

- Ultra Notch Filter: 488, 514.5, 532, 633, 785nm for measurement down to 10cm^{-1} and super notch filter for both Stokes and Anti-stokes. (-100cm^{-1} onwards)
- Edge and Bandpass (Plasma line)/Notch filter: 488, 514.5, 532, 633, 785nm for measurement down to 50cm^{-1}

* Please specify the number of excitation laser sources

Cooling / Heating Stage

TMHS600 temperature range: -196°C - 600°C
CCR4K temperature range: 4K - 400K

Diamond Anvil Cell

For High Pressure Raman Study

Polarized Raman Measurement

Laser power meter (up to 1W)

Features and specifications subject to change without notice.

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