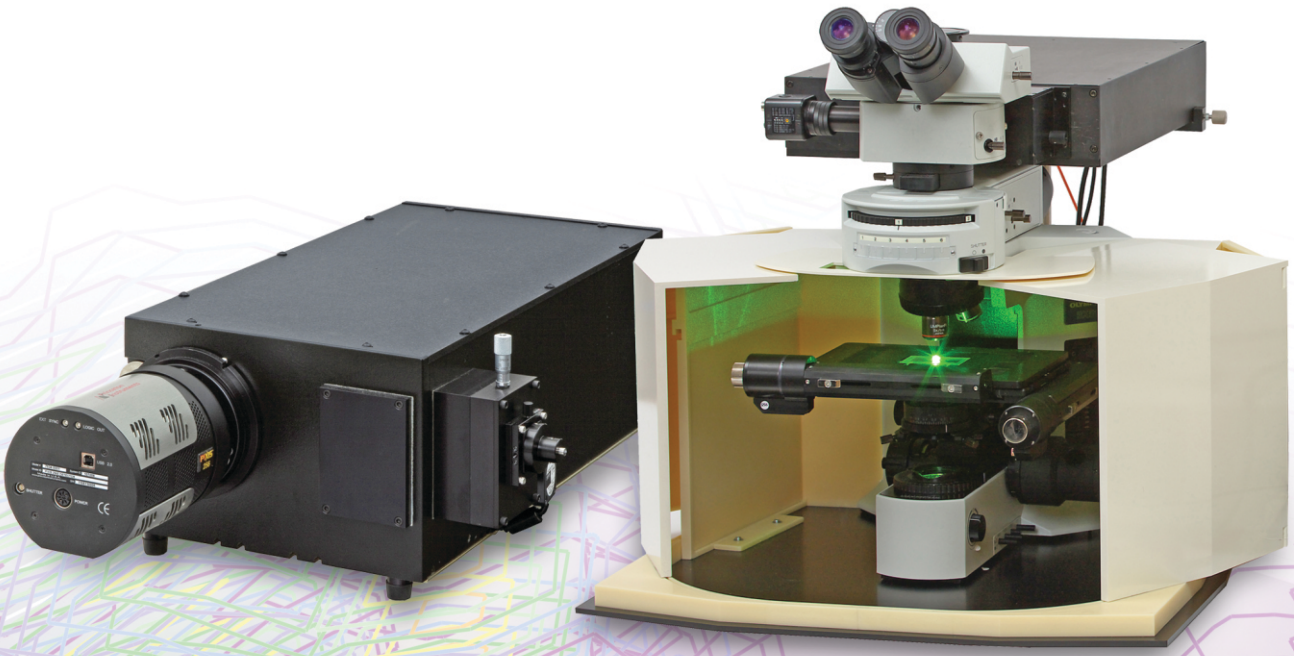
Laser Raman Spectrometer



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 deposits in liquid as it is (Particle ID Detection)
- Modular Approach and Customized solutions (UV-VIS-NIR etc.)

Laser Raman Spectrometer

STR series

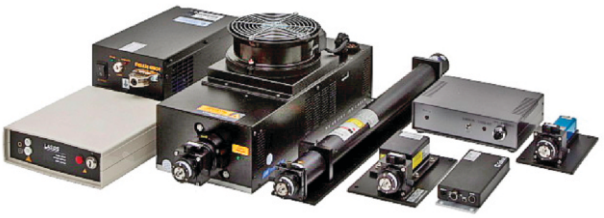
STR series Laser Raman Spectrometer is a new generation high resolution Raman Spectrometer with a high sensitivity to measure even a very weak Raman scattering from materials

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 compound. 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 U-V	10, 20, 50mW
He-Cd	325 / 442nm	X: 325nm Y: 422nm	15, 20, 30, 50mW 40, 50, 70mW
DL 532	532nm	Diode green	50mW, 100mW, 1.5W, 3 W
He-Ne	633nm	He Ne	17, 20, 35, 60mW
DL 785	785nm	Diode N-IR	100, 300, 500mW
DL 830	830nm	Air cooled diode	150mW
DL 1064	1064nm	Air cooled DPSS	500mW, 1W



Imaging Spectrograph

STR150	150mm Focal Length flat field : 25(27)mm(W) X 10(14)mm(H) Resolution: 1.1cm^{-1}/pixel
STR200/300 /500/750	200 /300 / 500 / 750mm Focal Length flat field: 27mm(W) X 14mm(H) Resoluion: 0.6/0.4/0.3/0.2cm^{-1}/pixel

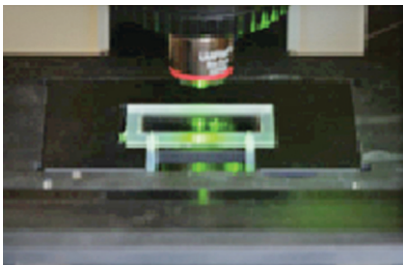
Cooled CCD camera *

CCD	Front / Back illuminated type ultra sensitive TE cooled CCD, Single & Multi channel (InGaAs)
EMCCD	For fast data collection

*Please refer specificition sheet for details

Optical Microscope

ST-BX54/LV /Ti(INV)*	Confocal Raman optical microscope with 500nm spatial resolution,< 2µm axial using x100 objective lens
	Motorized Raman optics assembly, Adj.Pin hole (WAO)
	Halogen Light (ref/trans),Bright & Dark Field Condenser
	Objective lens x5, x10, x20, x50, x100, UV lens
	CCD color video camera, LWD obj. x20, x50, x100
	Motorized ND Filters 0.01% to 100% (16 steps)
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)

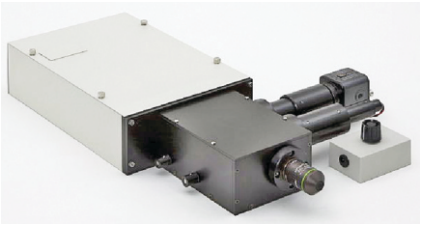


*Please consult us for additional specification

*M option: motorized revolver and halogen illuminator, Koehler LED
*P option (UV-PM, VIS-PM): Polarized Raman measurement, and observation,
*Step size: 0.1µm, Travel 3"X2", or 4"X3" or 5"X3" /w Joystick, Resolution XY:10nm and Z:2nm

Remote Raman Probe

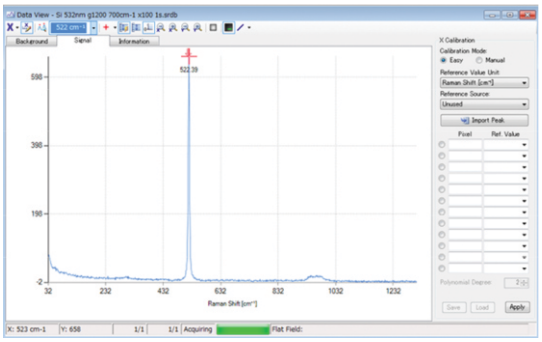
RPM-XX	> 25mm working distance
	Spot size < 5µm
	Raman filter set is common for both optical microscope and remote Raman probe and is easily exchangeable to other laser lines. Please consult us for other working distance



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



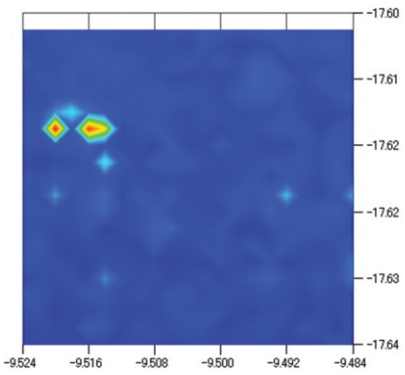
AutoMap Software for Auto XYZ Scanning and 2D, 3D, 4D Raman Imaging

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, in the most recently developed, 4D images.

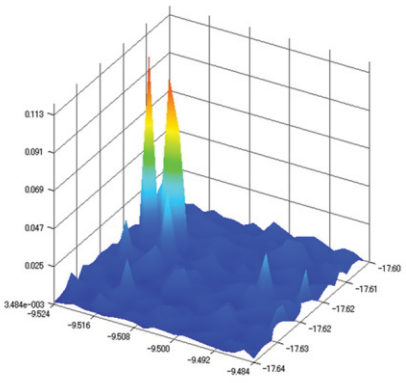
XY-Scanning, Z-Fixed

Example*: Measure Raman spectrum of the opal slice. Calculate the ratio of peak height (Peak height of quartz / Peak height of quartz + Peak height of cristobalite *1.89).

Plot coordinates of XY and ratio of the Peak height (Z)

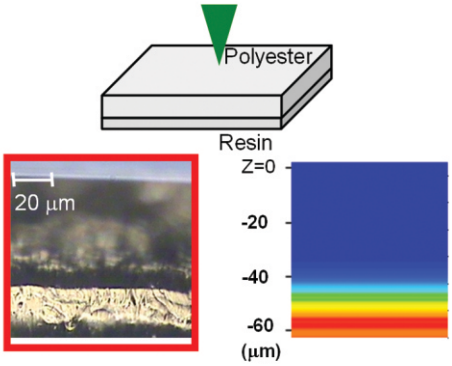


2D



3D

Lower the focus point from the surface of the film intervals of 1mm

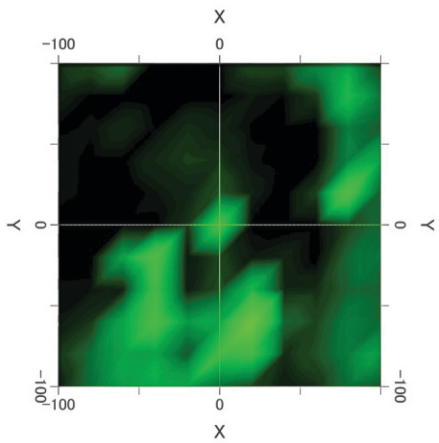


Confocal depth profiling

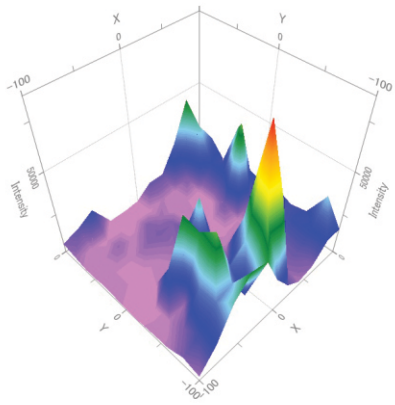
Data provided by K. Shinoda, Osaka City University

XYZ-Scanning and Raman Imaging in 2D, 3D and 4D

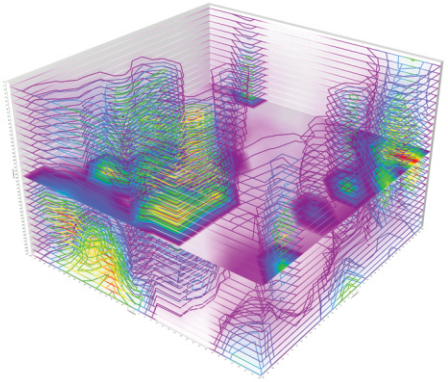
2D



3D



4D



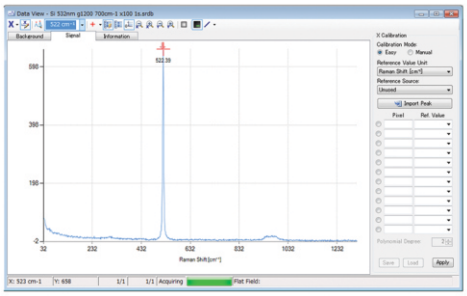
Integration with Standard Raman Data Processing, Application Examples

Data Processing Software

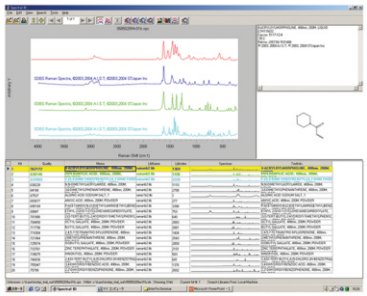
STR Data Collection Software output can be smoothly processed with other standard software, a premier solution for visualizing, processing and managing spectroscopy data and with functions of operation of the differentiation integration between spectra and curve fittings, de-convolution, etc. In addition, 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

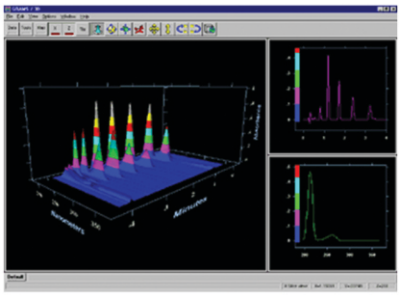
Data Processing Adds real-time, interactive 3D graphic visualization to the extensive list of capabilities already included. We can manipulate large 3D data sets in real-time on their PCs and see the unseen information hidden in multidimensional data.



Data collection software



Identification of unknown material

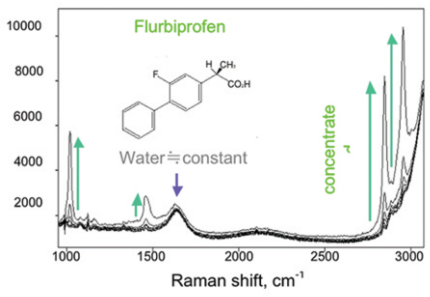


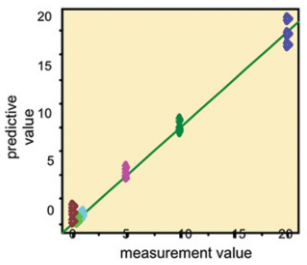
Displayed 3D image by Grams/3D

*by Thermo Scientific, USA

Multivariate Analysis Software PLSplus/IQTM*, PirouetteTM*

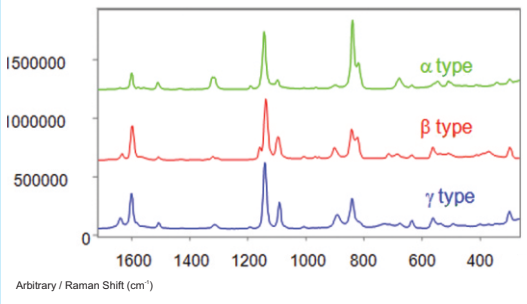
Quantitative analysis: This analysis is done by PLS method (Partial least squares regression). Construct the model with the solution concentration and relative intensity of Raman spectra. Physical properties of the sample are estimated from the calibration data set.



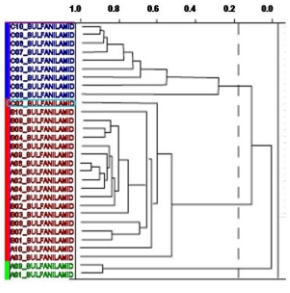


Even the ppm order is predictable!

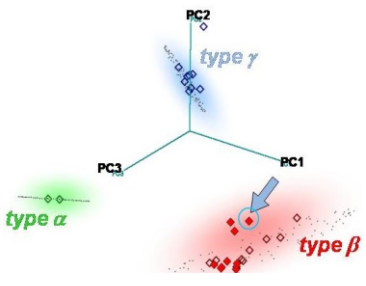
Polymorph Characterization (High Throughput Crystallization with 96 well plate): STR Data Collection Software output is smoothly combined with other software to automate crystallization data collection from micro well plates to quickly analyze and present meaningful information. The result is new levels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



Sulfanilamide Raman spectrum



SIMCA



HCA

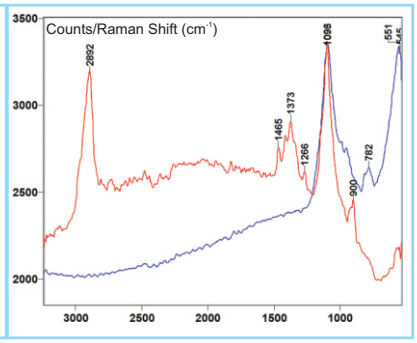
*by Infometrix Inc., USA

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.

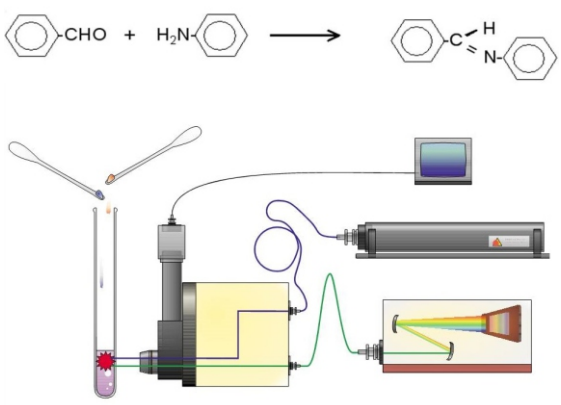
Automatic detection of solid foreign materials in liquid

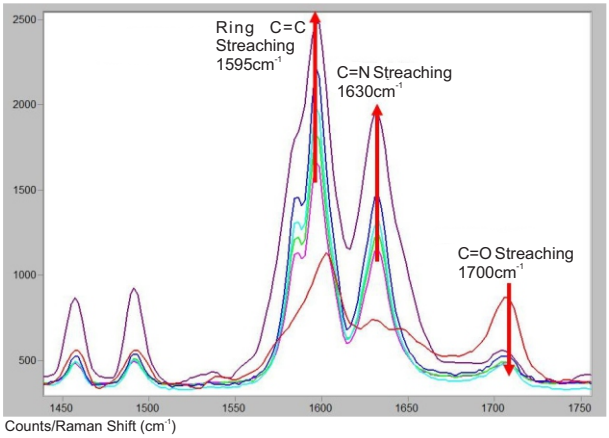
Photographic image and binarization image of foreign material



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})

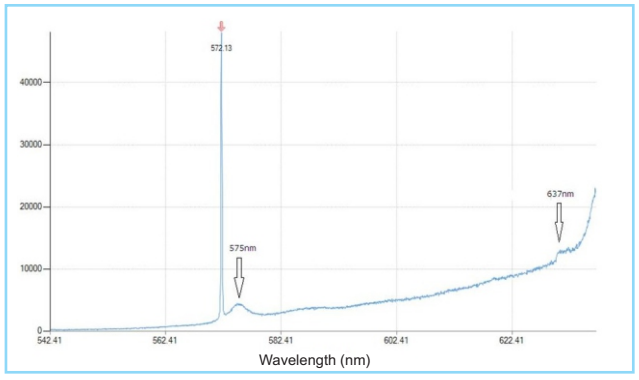




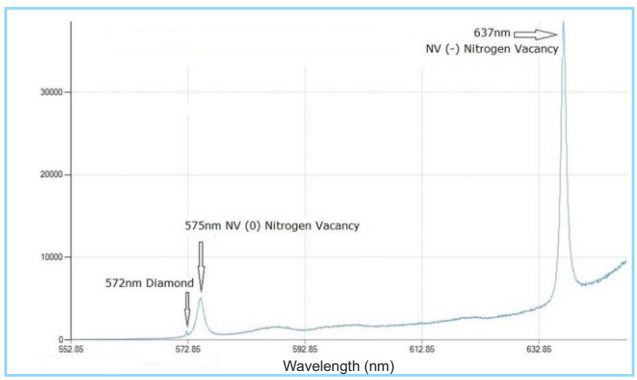
Time-dependent Raman spectra of Imine formation at intervals of every 2 minutes

Photoluminescence and Optical Emission Spectroscopy

Our STR series Raman Spectrometer, standalone equipment, is fully capable of carrying out Photoluminescence (PL) and Optical Emission Spectroscopy studies. The spectra in left and right, below, shows respectively the PL spectra of diamond taken at room temperature and at -100°C. The PL intensities of the nitrogen-vacancy points defects in diamond (i.e., NV(0) and NV(-)) increase 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*

DL 266	He-Cd-A/B	DL/SF-488	DL 532	HeNe633	DL 785	DL 830	DL 1064
DPSS Deep UV Laser 266nm 10, 20, 50mW	He-Cd A: 325nm, 15, 20, 30, 50mW B: 442nm, 50, 70, 100mW	488nm 50mW, 1000mW	DPSS Nd-YAG Green Laser 532nm 50, 100, 500mW 1.5W, 3W	He-Ne 633nm 17, 20, 35, 60mW	Diode Near-IR 785nm 100, 300, 500mW	Air cooled diode 830nm 150mW	DPSS Nd-YAG 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 option

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. Spectra repeatability <0.1cm^{-1} , Spectra Scan linearity <0.5cm^{-1}

Spectrum range: 200 - 2100nm, Raman shift: 5 - 5000cm^{-1}

*x: number of gratings, Resolution @532nm, 15μm CCD 300g, 600g,1200g,*1800g, ** 2400g

Second exit port available for future up gradation with CCD/PMT

Cooled CCD camera

	316LDC-DD	iVac-FI	DU416A	InGaAs
Format	2000x256 pixels, 15x15μm	1650 X 200 pixels, 16x16μm	2000 X 256 pixels, 15x15μm	1024 x 1 pixel, 25 x 500μm
Range	200-1100nm (UV-NIR)	380-1100nm (VIS-NIR)	200-1100nm (UV-NIR)	0.6μm to 1.7μm
QE	>95% @780nm	>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-XX

>25 mm Working distance , Spot size < 5 μm
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, 457, 488, 514.5, 532, 633, 785nm

Please consult us for additional specifications.

Piezo XYZ stage

XY 200um, Z 25um 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.

Cooling / Heating Stage

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

Diamond Anvil Cell

High Pressure Raman Study

Polarized Raman Measurement

Laser power meter (10pW - 1W)

* Please specify the number of excitation laser sources, Laser power meter option: up to 1W
* 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/Notch filter: 325,488, 514.5, 532, 633, 785nm for measurement down to 50cm^{-1}

Features and specifications subject to change without notice.

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