

RAMAN SPECTROSCOPY

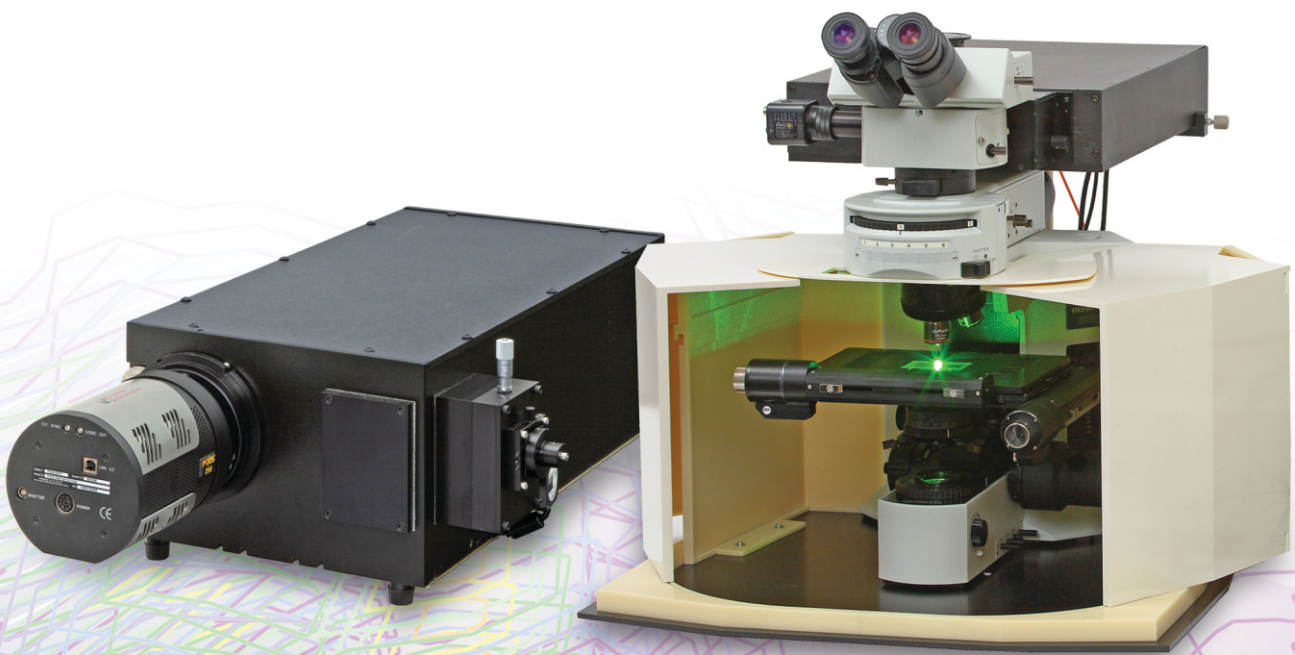


Installation Date- 10/12/12

**Model name- STR 500
(cornestechologies Ltd, Japan)**

Invoice No- CTL-324/12

Laser Raman Spectrometer



Features

- Compact & Flexible System Configuration
- High Resolution: $< 0.3\text{cm}^{-1}$
- 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.)

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 <math> < 1\mu\text{m}</math> 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



*Please refer specification sheet for details

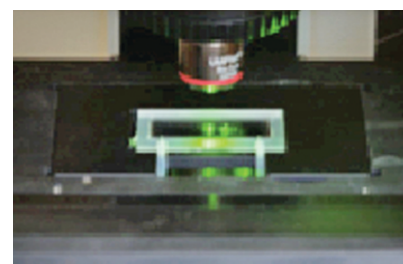
Cooled CCD camera *

CCD Front / Back illuminated type ultra sensitive TE cooled CCD, Single & Multi channel (InGaAs)

EMCCD For fast data collection

Optical Microscope

ST-BX54/LV /Ti(INV)* Confocal Raman optical microscope with 500nm spatial resolution, <math> < 2\mu\text{m}</math> 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)



*Please consult us for additional specification

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, Koehler LED

*P option (UV-PM, VIS-PM): Polarized Raman measurement, and observation,

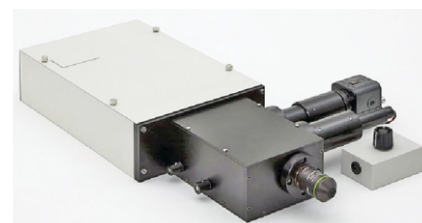
*Step size: 0.1μm, Travel 3"X2", or 4"X3" or 5"X3" /w Joystick, Resolution XY:10nm and Z:2nm

Remote Raman Probe

RPM-XX > 25mm working distance

Spot size <math> < 5\mu\text{m}</math>

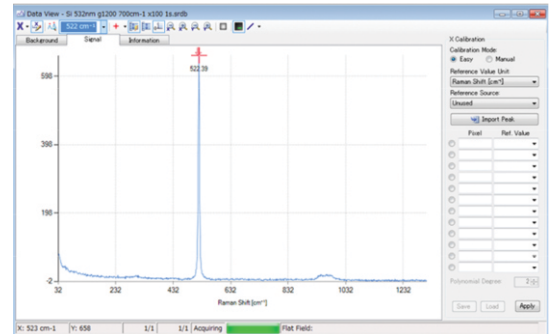
Raman filter set is common for both optical microscope and remote Raman probe and is easily exchangeable to other laser lines. Please consult us for other working distance



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



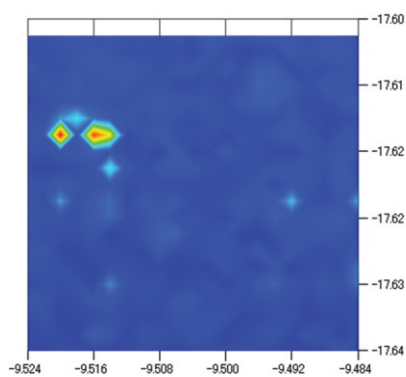
AutoMap Software for Auto XYZ Scanning and 2D, 3D, 4D Raman Imaging

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.

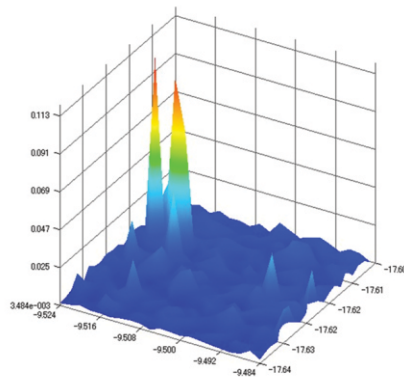
XY-Scanning, Z-Fixed

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)

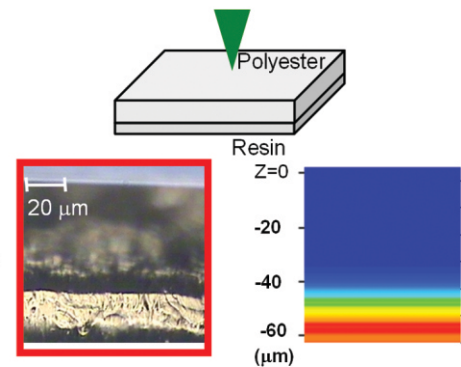


2D



3D

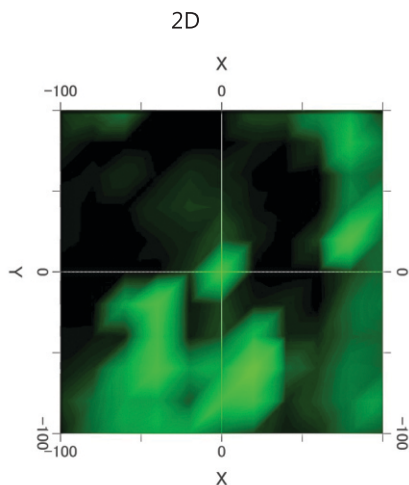
Lower the focus point from the surface of the film intervals of 1mm



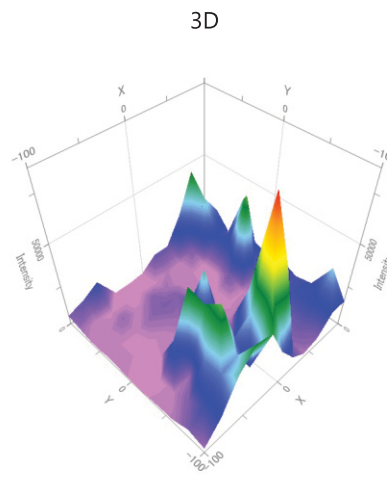
Confocal depth profiling

*Data provided by K. Shinoda, Osaka City University

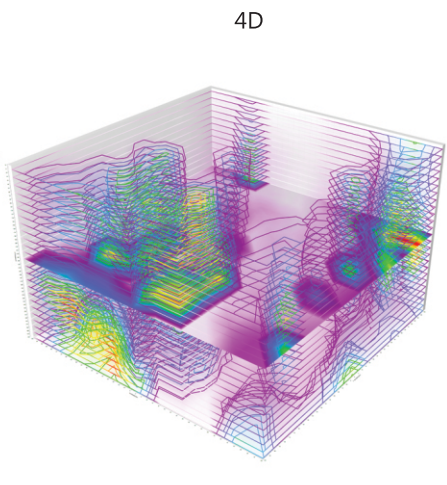
XYZ-Scanning and Raman Imaging in 2D, 3D and 4D



2D



3D



4D

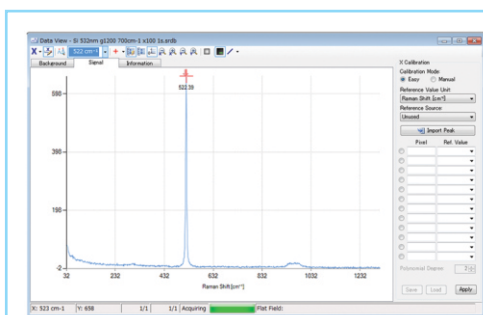
Integration with Standard Raman Data Processing, Application Examples

Data Processing Software

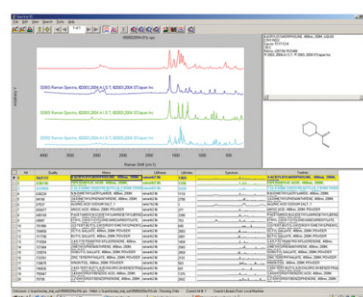
STR Data Collection Software output can be smoothly processed with other standard software, a premier solution for visualizing, processing and managing spectroscopy data and with functions of operation of the differentiation integration between spectra and curve fittings, de-convolution, etc. In addition,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

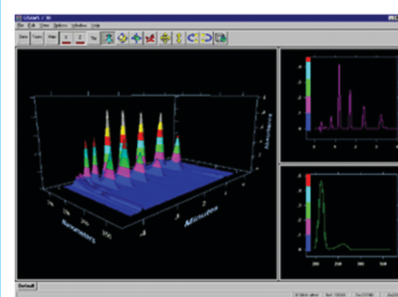
Data Processing Adds real-time, interactive 3D graphic visualization to the extensive list of capabilities already included. We can manipulate large 3D data sets in real-time on their PCs and see the unseen information hidden in multidimensional data.



Data collection software



Identification of unknown material

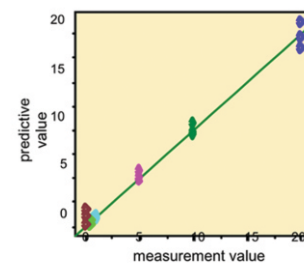
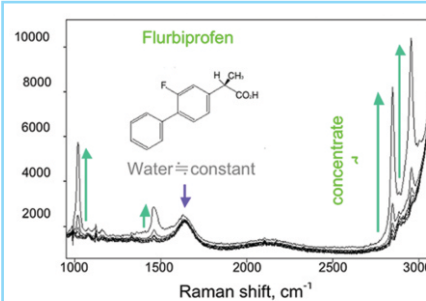


Displayed 3D image by Grams/3D

*by Thermo Scientific, USA

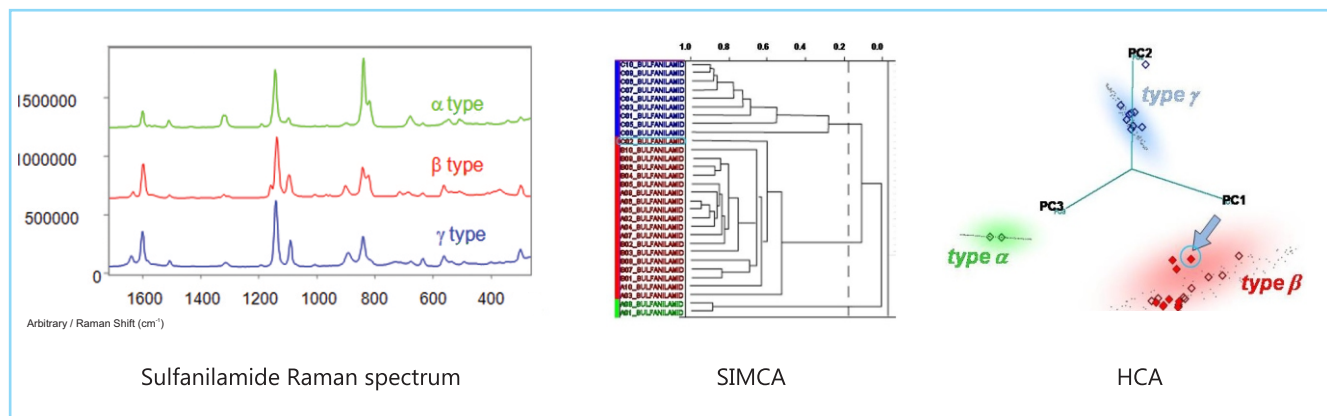
Multivariate Analysis Software PLSplus/IQTM*, Pirouette™*

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

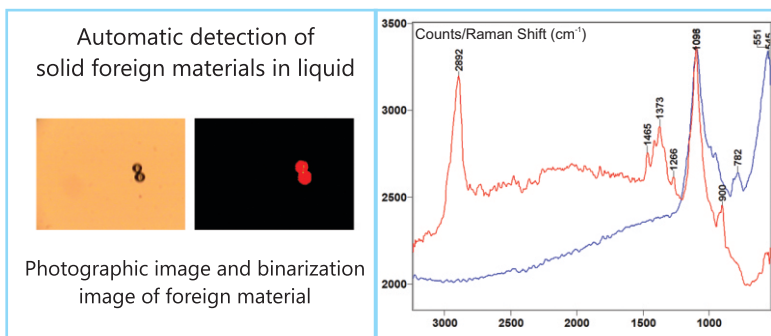
SIMCA

HCA

*by Infometrix Inc., USA

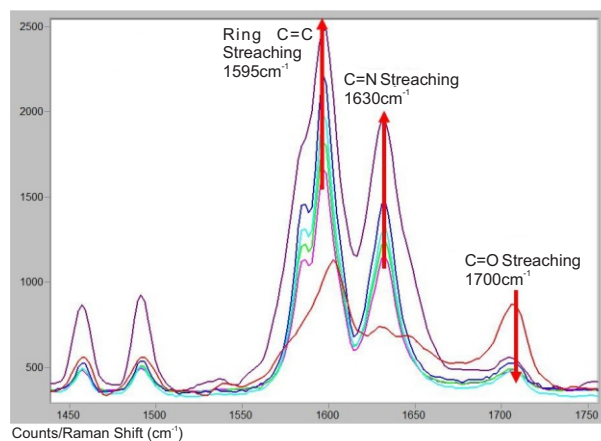
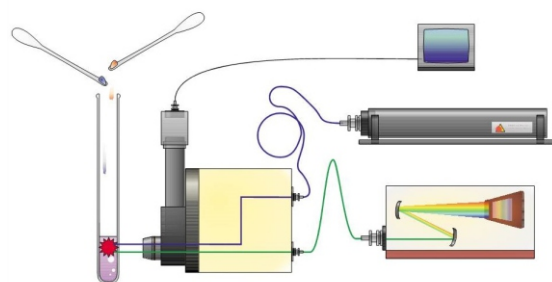
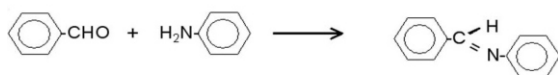
Auto Detection of Foreign Materials in Injected Liquid

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.



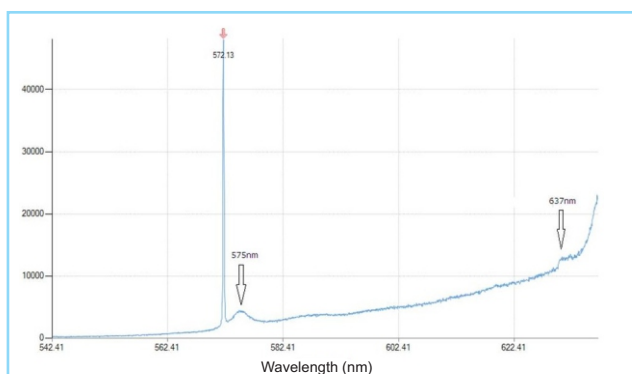
Process Monitoring by Remote Raman Probe System

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)

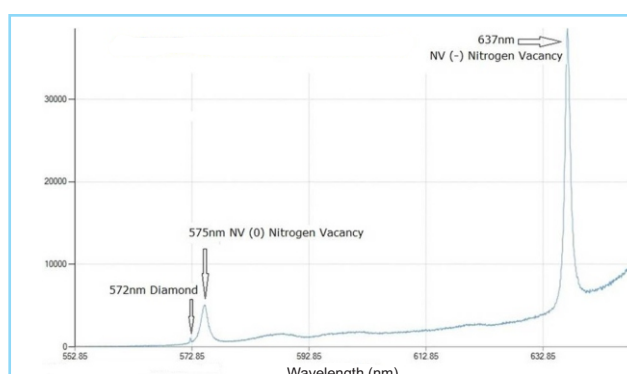


Photoluminescence and Optical Emission Spectroscopy

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

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: 10_μm - 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, 15_μm 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, 15x15 _μ m	1650 X 200 pixels, 16x16 _μ m	2000 X 256 pixels, 15x15 _μ m	1024 x 1 pixel, 25 x 500 _μ m
Range	200-1100nm (UV-NIR)	380-1100nm (VIS-NIR)	200-1100nm (UV-NIR)	0.6 _μ m to 1.7 _μ m
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)

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.

Remote Raman Probe-XX

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

Piezo XYZ stage

XY 200_μm, Z 25_μm 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.

* 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.

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)

Distributor

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