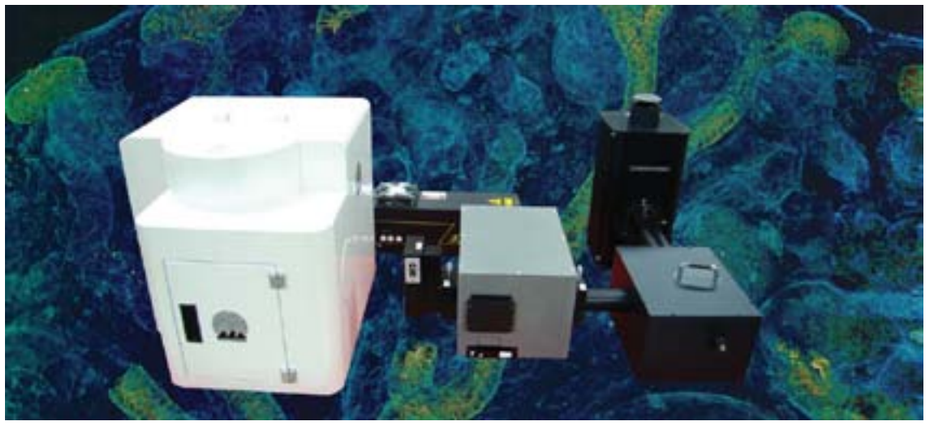
Ramboss-500i

Micro Raman Measurement system

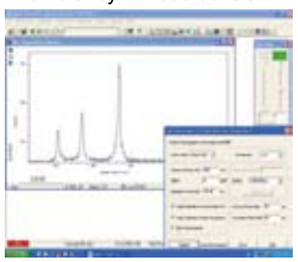


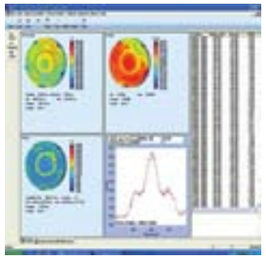
Features

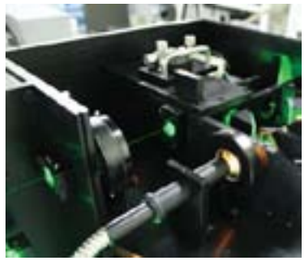
- High performance confocal spectroscopic micro sample chamber
- 1um beam spot size and 1um step mapping resolution
- Raman shift resolution : 2cm-1 @632.8nm, 1800gr/mm grating
- Low noise, low dark current, high quantum efficiency TE cooled CCD

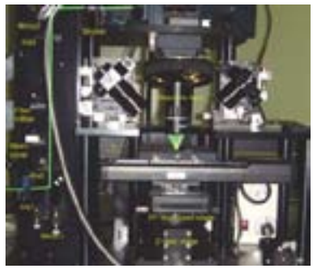
Application

- Raman spectroscopy
- Chemical Systems & processing
- Pharmaceuticals
- Biological & medical systems
- food & forensic applications









Specifications

1. 632.8nm He-Ne Excitation Laser set

- output power : 20mW He-Ne laser set

HeNe Lasers

2. Microscope Raman sample Chamber

- High performance Spectroscopic Micro Sample Chamber
- Beam spot resolution:approx. 1um @ 100x Objective lens @TEMoo Mode (TFS : Theoretical Focal Spot size)
- Microscopic body and XY stage for Micro Raman.
  1) 100x, M-Plan Objective lens W.D:6mm
  2) 50x, S-Plan Objective lens W.D:20mm
- High reflectance Mirrors for excitation wavelength, UV-VIS-NIR
- Max. 1600x CCD camera Sample Monitoring system
- Raman Edge filter set for 632.8nm
- system integration and test evaluation with Si wafer

3. High resolution spectrograph, MonoRa500i

- Focal length: 500mm.
- Resolution: 0.045nm @435.8 nm (1200gr/mm grating) with 10 um slits
- Optical path: f/6.5 imaging Czerny-Turner spectrometer
- Grating Turret: triple grating (68 mm x 68 mm) turret,
- Interface: USB & RS232 Standard
- Accuracy: +/- 0.2nm
- A micrometer controlled adjustable slit assembly for entrance, 0 to 5mm (10micrometer step)
- includes Gratings ;
  1) 3-180-450H, Holographic Grating, 1800G/mm, 300nm- 900nm wavelength spectral coverage : 28nm
  2) 3-300-500, Ruled Grating, 300G/mm, 500nm blazed, 300nm-1000nm range spectral coverage : 128nm,

MonoRa500i

iDUS.CCD Detector

4. High performance, TE cooled CCD detection set

- Back-illuminated type CCD
- Pixel format : 1024x128 pixels,
- Pixel size : 26um pixel size
- Dark Current : 0.01e- /pix/sec
- Minimum operating Temp : -70°C /TE cooled, with water circulator
- Spectral Range : 200-1050nm
- Includes 16bits, 100KHz, USB interface
- includes Data acquisition processor, Window XP Ver. & 19" TFT-LCD monitor

Available Lasers

- 266nm DPSS, 325nm He-Cd lasers, 488, 514nm Ar laser set, 532nm DPSS, 632.8nm He-Ne, 785nm LD lasers
  * It can be changed above specifications for system upgrade without notice

DPSS Green Laser

DPSS Blue Laser

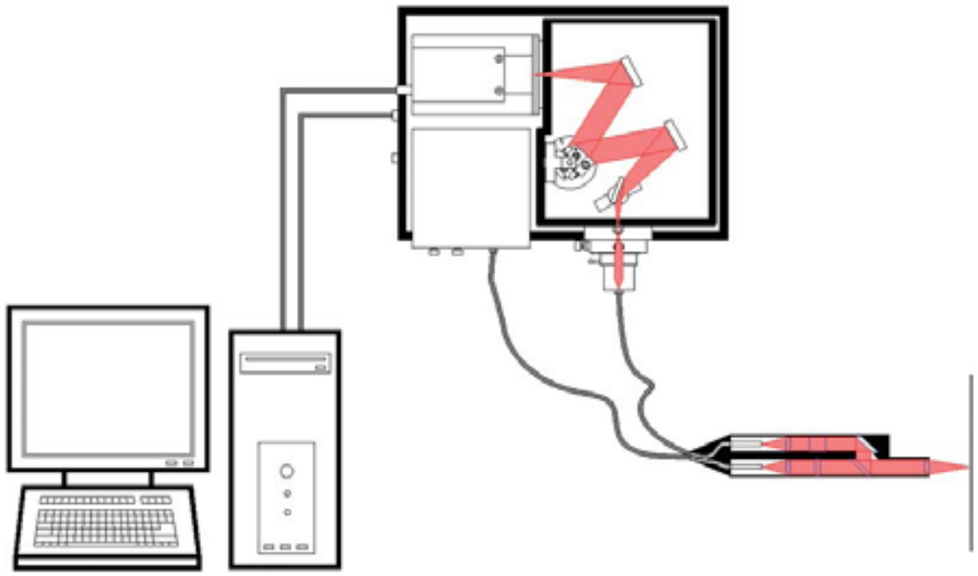
Ar laser

Ordering Information

- Ramboss- 500i : Laser + Raman Chamber + MonoRa500i + TE Cooled CCD Detector + Mapping stage
- Ramboss-T500i : Laser + Raman Chamber + Triple MonoRa500i + TE Cooled CCD Detector + Mapping stage

System 1

Compact Vis-NIR Raman W/raman probe



Macro Probe Raman Measurement system

1.I0785MM0350M, 785 nm User Configurable, Spectrum,
- Stabilized Laser Module with 350 mW of output power and

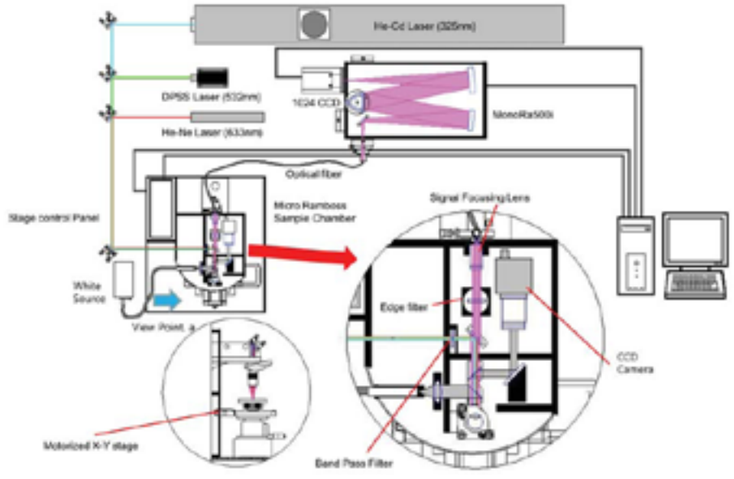
2. MonoRa151i, 150mm focal length monochromator
- Resolution : 0.2nm @ 435.8nm (1200gr/mm grating), 10 um slits
- Focal length : 150mm,
- Interface: RS232 & USB standard
- Included fiber align holder

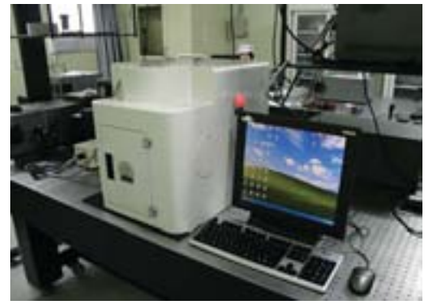
3. High performance TE cooled CCD detection set
- Back-illuminated type CCD
- Pixel format : 1024x128 pixels,
- Minimum operating Temp : -70°C /TE cooled.
- Spectral Range : 200-1050nm

4. Fiber optic Raman Probe station and sample holder for Solid and Liquid
- 100um excitation fiber, 200um collection fiber with filtering and steering Micro-optics with SMA type coupling
- Stainless-steel, cylindrical probe head, 0.5” dia. X 4” length with integrated Fiber optic, 2 meters
- Spectral range : 300 - 3900 cm-1 (Stokes)
- Working distance : 7. 5 mm
- Output beam spot size : 8 - 10 mm dia.

System 2

UV-VIS-NIR Micro Raman



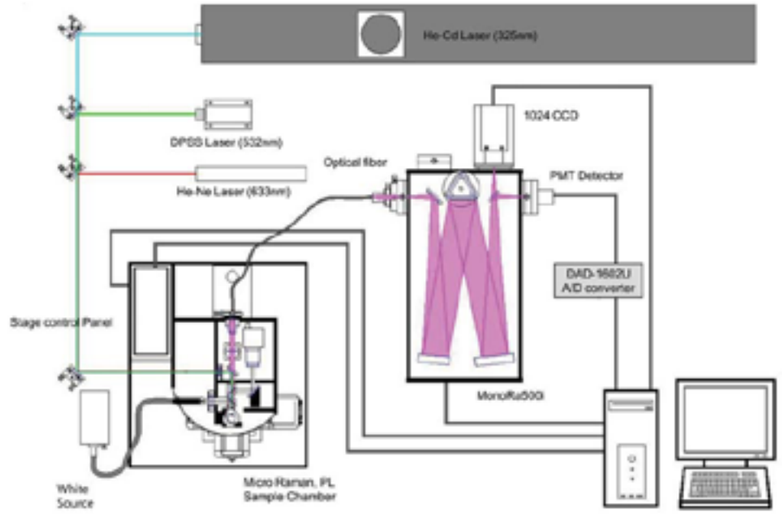


UV-VIS-NIR Micro Raman system

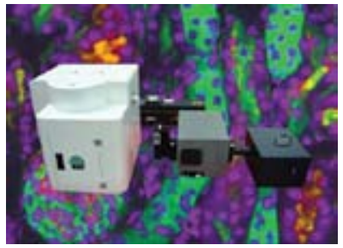
1. Excitation Laser source
   A. LDM830100CWA 830nm Solid State Laser Set
   - Output power : 100mW @ 830nm
   B. FKL532.50.CWA.L 532nm Solid State Laser Set
   - Output power : 50mW @ 532nm
   C. IK3501R-G, 325nm HeCd laser set
   - output power : 50mW @ 325nm TEM00 mode
2. Ramboss-500i, Micro Raman sample chamber
   - High performance Spectroscopic Micro Sample Chamber
   - Using the Wide aperture and Long Working Distance M-plan Objective Lens
   - Beam spot resolution : approx. 1um @ 100x Objective lens @TEMoo Mode (TFS : Theoretical Focal Spot size)
   - microscopic body and motorized XY stage for Micro Raman mapping 3-5 um backlash, UV-NIR objective lens
   - High reflectance Mirrors for excitation wavelength, UV-VIS-NIR
   - Max. 10000x CCD camera Sample Monitoring system
   - Raman Edge filter & bandpass filter

3. MonoRa-512i Monochromator / Spectrograph
   - Resolution : 0.045nm @ 435.8 nm (1200gr/mm grating), 10 um slits
   - Focal length : 500mm,
   - Raman shift from 100Cm-1 to 567Cm-1 with 1200gr/mm @830nm with 41 nm coverage (Theoretical value)
   - Raman shift system resolution : <1.8cm-1 @830nm, 1200gr/mm (Theoretical value)
4. High performance TE cooled CCD detection set
   - Back-illuminated type CCD
   - Pixel format : 1024x128 pixels,
   - Minimum operating Temp : -70°C /TE cooled.
   - Spectral Range : 200-1050nm

System 3
UV-VIS-NIR Micro Raman + PL



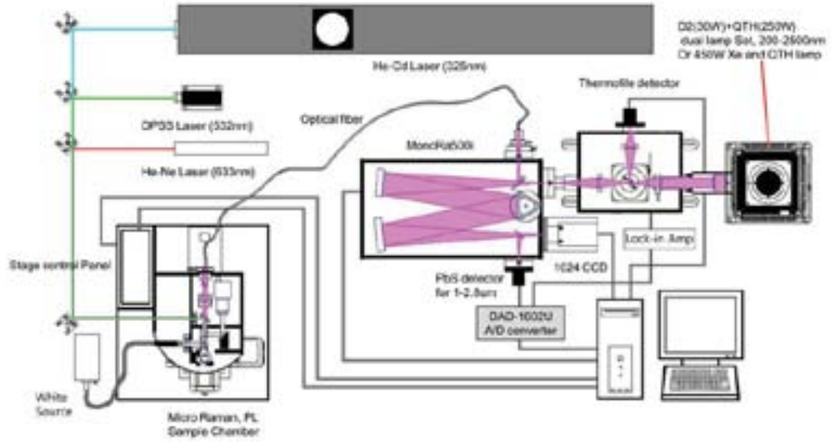
UV-VIS-NIR Micro Raman+PL measurement system



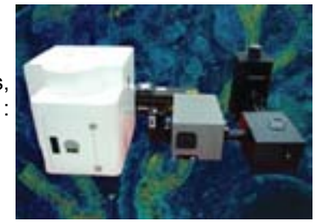
1. Excitation Laser source
   A. LDM830100CWA 830nm Solid State Laser Set
   - Output power : 100mW / Mode: TEM00
   B. FKL532.50.CWA.L 532nm Solid State Laser Set
   - Output power: 50mW / Mode : TEM00
   C. IK3501R-G, 325nm HeCd laser set
   - output power : 50mW
2. Ramboss-500i, Micro Raman sample chamber
   - High performance Spectroscopic Micro Sample Chamber
   - Using the Wide aperture and Long Working Distance M-plan Objective Lens
   - Beam spot resolution : approx. 1um @ 100x Objective lens @TEMoo Mode (TFS : Theoretical Focal Spot size)
   - microscopic body and motorized XY stage for Micro Raman mapping 3-5 um backlash, UV-NIR objective lens
   - High reflectance Mirrors for excitation wavelength, UV-VIS-NIR
   - Max. 10000x CCD camera Sample Monitoring system
   - Raman Edge filter & bandpass filter

3. MonoRa-512i Monochromator/Spectrograph
   - Resolution : 0.045nm @ 435.8 nm (1200gr/mm grating), 10 um slits
   - Focal length : 500mm,
   - Raman shift from 100Cm-1 to 567Cm-1 with 1200gr/mm @830nm with 41 nm coverage (Theoretical value)
   - Raman shift system resolution : <1.8cm-1 @830nm, 1200gr / mm (Theoretical value)
4. High performance TE cooled CCD detection set
   - Back-illuminated type CCD
   - Pixel format : 1024x128 pixels,
   - Minimum operating Temp : -70°C /TE cooled.
   - Spectral Range : 200-1050nm

System 4
UV-VIS-NIR Micro Raman + ATR

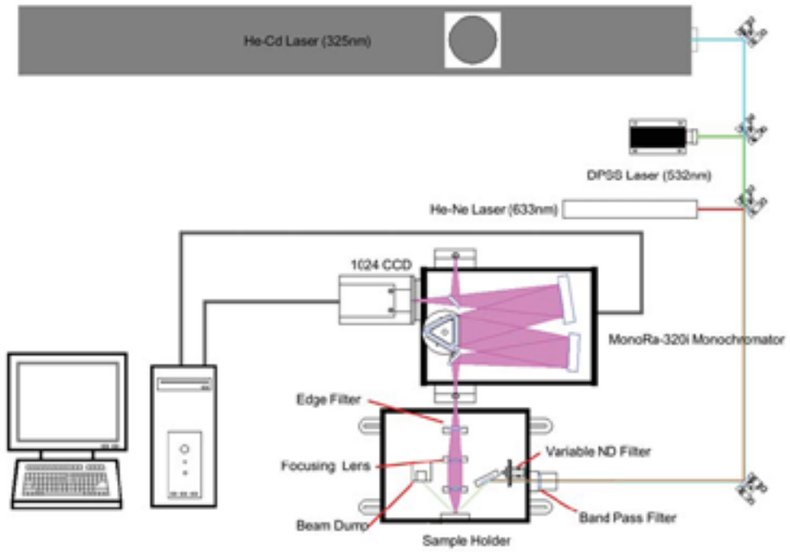


UV VIS NIR Micro Raman mapping ATR Measurement system

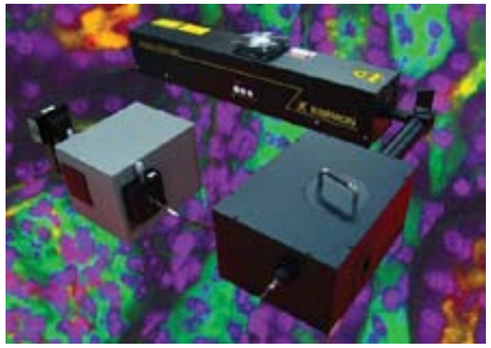


1. A.532nm DPSS Excitation Laser source
   - 100mW, TEMoo Mode
   B. LDM830100CWA 830nm Solid State Laser Set
   - Output power: 100mW, TEM00
   C. IK3202R-D, 25mW, 325nm HeCd laser set
   - Air cooled, TEM multi mode, 1.6mm beam dia.
2. Ramboss-500I, Micro Raman sample chamber
   - High performance Spectroscopic Micro Sample Chamber
   - Using the Wide aperture and Long Working Distance M-plan Objective Lens
   - Beam spot resolution : approx. 1um @ 100x Objective lens @TEMoo Mode (TFS : Theoretical Focal Spot size)
   - microscopic body and motorized XY stage for Micro Raman mapping 3-5 um backlash, UV-NIR objective lens
   - Max. 10000x CCD camera Sample Monitoring system
   - Raman Edge filter & bandpass filter
3. MonoRa-512i Monochromator / Spectrograph
   - Resolution : 0.045nm @ 435.8 nm (1200gr/mm grating), 10 um slits
   - Focal length : 500mm,
   - Raman shift from 100Cm-1 to 567Cm-1 with 1200gr/mm @830nm with 41 nm coverage (Theoretical value)
   - Raman shift system resolution : <1.8cm-1 @830nm, 1200gr/mm (Theoretical value)
4. High performance TE cooled CCD detection set
   - Back-illuminated type CCD
   - Pixel format : 1024x128 pixels,
   - Spectral Range : 200-1050nm
5. PBS-020-TE2. two Stage TEC PbS Detector
   - Wavelength Range : 1um to 2.8um UV-NIR transmittance & reflectance system
1. MonoRa201, 200mm focal length monochromator
   - Resolution: 0.18nm @ 435.8 nm (1200gr/mm grating), 10 um slits
   - Focal length: 200mm.
2. DL300-XE, 300W Xe arc Lamp set
   - spectral range : 260-2000nm, ozone free lamp
3. DL250-TH. 250W Tungsten Halogen Light Source
   - Provides output from 350nm to>2.0um.
4. OSF-6, Manual Order sorting filter wheel assembly
   - standard order sorting filters : 400nm, 500nm, 600nm, and 720nm.
5. Sample Chamber
   - Includes 30mm dia., Fusedsilica PL/CX lens,
   - Variable ND filter, Bandpass & cutoff filter
   - Sample holder, rotation & translation stage set
6. DAD-1602U, 16Bit AD/DA data acquisition set
7. Monoworks, Data acquisition & processing software
8. PBS-020-TE2. two Stage TEC PbS Detector
   - Wavelength Range: 1um to 2.8um
9. M300CD, Digital Display Chopper
10. M410, Single Phase Lock-in Amplifier

System 5
UV-VIS-NIR Macro Raman



UV-VIS-NIR Macro Raman Measurement system



Excitation Laser source

1.IK3401R-F, 40mW, 325nm HeCd laser set
- Air cooled, TEM00 mode, 1.2mm beam dia.,

2. FKL532.150.CWA.L, 532nm Solid State Laser Set
- Output power: 150mW TEM00

3. LDM785.150.CWA 785nm diode Laser source
- Output power: 150Mw TEM00

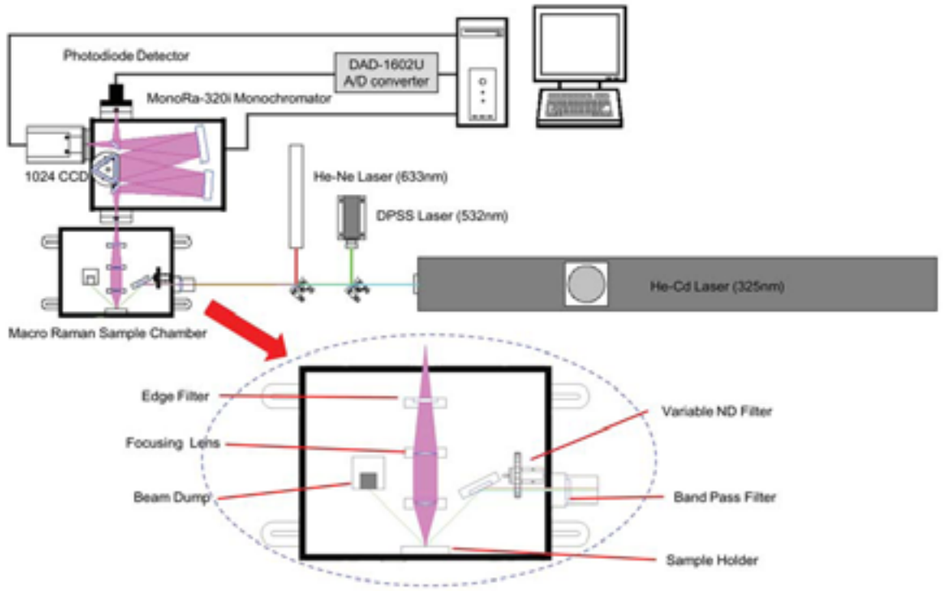
4. Raman Sample Chamber
- Includes 40mm dia., FusedSilica PL/CX lens, Beam diverting mirror
- Variable ND filter, Bandpass filter (3nm FWHM, for three laser source)
- 10 mm aperature beam dump, raman edge filter. (for three laser source)

5. PL detection detector set
1) MonoRa324i, 320mm focal length multi-port Monochromator / spectrograph
- Resolution: 0.09nm @ 435.8 nm (1200gr/mm grating), 10um slits
- Focal length: 320mm,
- Raman shift range 100Cm-1 to 6000Cm-1 with 1200gr/mm @532nm

2)DV401A-BV CCD Detector
- Sensor Option: Back illuminated CCD
- Active Pixels: 1024x127
- Wavelength range : 200- 1000 nm

3)Data acquisition & processing system

System 6
UV-VIS-NIR Macro Raman + PL



UV-VIS-NIR Macro Raman PL Measurement system

Excitation Laser source

1.IK3401R-F, 40mW, 325nm HeCd laser set
- Air cooled, TEM00 mode, 1.2mm beam dia.,

2. 532nm DPSS Excitation Laser source
- 100mW, TEMoo Mode

3.LDM785.150.CWA 785nm diode Laser source
- Output power: 150mW TEM00

4. Raman Sample Chamber
- Includes 40mm dia., FusedSilica PL / CX lens, Beam diverting mirror
- Variable ND filter, Bandpass filter (3nm FWHM, for three laser source)
- 10 mm aperature beam dump, raman edge filter. (for three laser source)
- Sample holder for cuvette cell(liquid sample)
- X axis rack and pinion dovetail stage for focusing

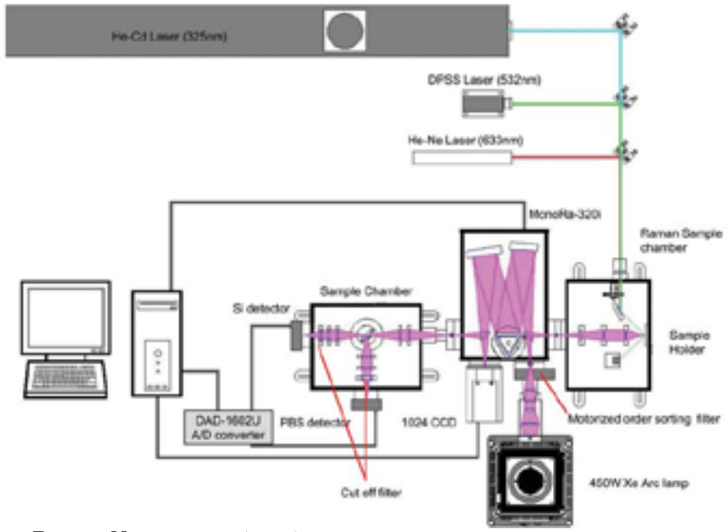
5. PL detection detector set
1) MonoRa324i, 320mm focal length multi-port Monochromator/spectrograph
- Resolution: 0.09nm @ 435.8 nm (1200gr / mm grating), 10um slits
- Focal length: 320mm,
- Raman shift range 100Cm-1 to 6000Cm-1 with 1200gr/mm @532nm

2) DV401A-BV CCD Detector
- Sensor Option: Back illuminated CCD
- Active Pixels: 1024x127
- Wavelength range : 200- 1000 nm

3)Data acquisition & processing system

System 7

UV-VIS-NIR Macro Raman + PL + Fluorescence / ATR



UV-VIS-NIR Macro Raman Measurement system

Macro Raman system
Excitation Laser source
1.IK3401R-F, 40mW, 325nm HeCd laser set
- Air cooled, TEM00 mode, 1.2mm beam dia.

2. 532nm DPSS Excitation Laser source
- 100mW, TEMoo Mode

3.LDM785.150.CWA 785nm diode Laser source
- Output power: 150mW TEM00

4. Raman Sample Chamber
- Includes 40mm dia., FusedSilica PL/CX lens, Beam diverting mirror Variable ND filter, Bandpass filter (3nm FWHM, for three laser source)
- 10 mm aperature beam dump, raman edge filter. (for three laser source)
- X axis rack and pinion dovetail stage for focusing

5. PL detection detector set
1) MonoRa324i, 320mm focal length multi-port Monochromator/spectrograph
- Resolution: 0.09nm @ 435.8 nm (1200gr/mm grating), 10um slits
- Focal length : 320mm,
- Raman shift range 100Cm-1 to 6000Cm-1 with 1200gr/mm @532nm

2) DV401A-BV CCD Detector
- Sensor Option : Back illuminated AR coated for optimal performance in VIS
- Active Pixels: 1024x127
- Wavelength range : 200- 1000 nm

UV-NIR transmitt & reflectance system
6. 450W Xe arc lamp set
- 450W Xe lamp (Hamamatsu or Ushio lamp) with vertical type lamp housing
- spectral range : 260-2000nm, ozone free lamp

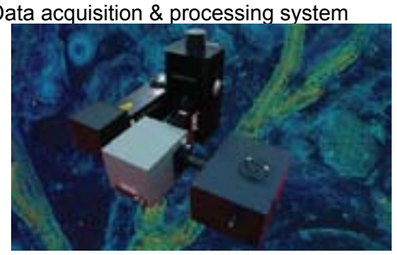
7. MOSF-6, Motorized Order sorting filter wheel assembly, installed
- Standard order sorting filters : 400nm, 500nm, 600nm,

8.SC100A ART Sample Chamber with IN/OUT Mount
- Included reference cell and shortwave pass filt for 200-500 nm(exciting source range)
- Motorized Rotation sample holder for angle scan with 0.1 degree resolution

9.S-050(or025)-TE2-H, TE cooled Si photodiode set
- 200-1100 nm 2.5 mm or 5 mm dia.

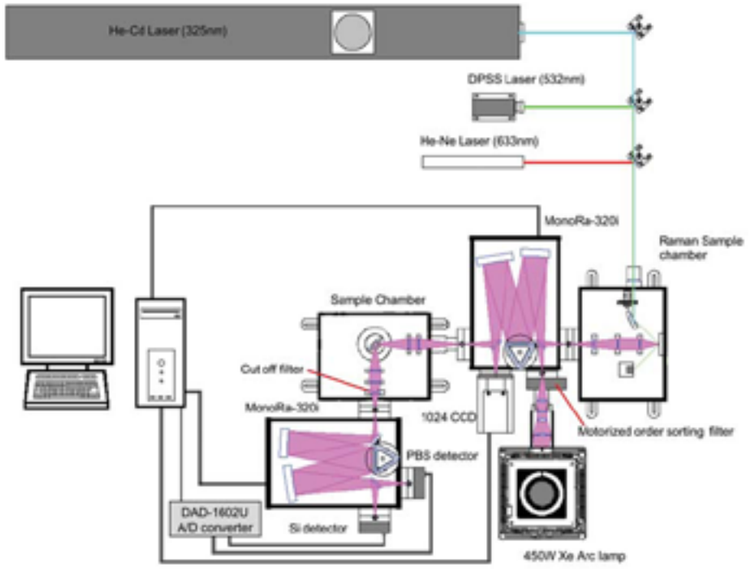
10. PBS-020-TE2. two Stage TEC PbS Detector
- Wavelength Range : 1um to 2.8um

11. DAD-1602U, 16Bit AD / DA data acquisition set,
12.Monoworks, Data acquisition & processing software
13.Data acquisition & processing system



System 8

UV-VIS-NIR Macro Raman + PL



UV-VIS-NIR Macro Raman PL PLE Measurement system

Macro Raman PL PLE system
1.IK3401R-F, 40mW, 325nm HeCd laser set
- Air cooled, TEM00 mode, 1.2mm beam dia.,

2. 532nm DPSS Excitation Laser source
- 100mW, TEMoo Mode

3.LDM785.150.CWA 785nm diode Laser source \
- Output power: 150mW TEM00

4.SCP200, Raman Sample Chamber
- Includes 40mm dia., FusedSilica PL/CX lens, Beam diverting mirror Variable ND filter, Bandpass filter(3nm FWHM, for three laser source)
- 10 mm aperature beam dump, raman edge filter. (for three laser source)

5. PL detection detector set
1) MonoRa324i, 320mm focal length multi-port Monochromator/spectrograph
- Resolution : 0.09nm @ 435.8 nm (1200gr/mm grating), 10um slits
- Focal length : 320mm,
- Raman shift range 100Cm-1 to 6000Cm-1 with 1200gr/mm @532nm

2) DV401A-BV CCD Detector
- Sensor Option: Back illuminated CCD
- Active Pixels: 1024x127
- Wavelength range : 200- 1000 nm

UV-NIR PLE system
6.MonoRa324i, 320mm focal length multi-port Monochromator / spectrograph
- Resolution: 0.09nm @ 435.8 nm (1200gr/mm grating), 10um slits
- Focal length: 320mm,

7. 450W Xe arc lamp set
- spectral range : 260-2000nm, ozone free 450W lamp

8. MOSF-6, Motorized Order sorting filter wheel assembly, installed
- Standard order sorting filters : 400nm, 500nm, 600nm,

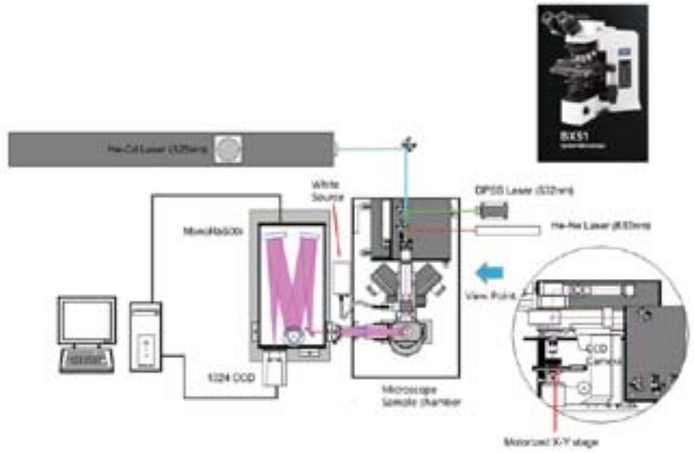
9. PLE Sample Chamber with IN/OUT Mount 25mm dia. Fused Silica lens, Biconvex, 4pcs included (please specify focal length)
- Adjustable sample holder.(cuvette cell or wafer) and cutoff filter & filter holder
- Motorized Rotation sample holder for angle scan with 0.1 degree resolution

10.S-050(or025)-TE2-H, TE cooled Si photodiode set
- 200-1100 nm 2.5 mm or 5 mm dia.

11. PBS-020-TE2. two Stage TEC PbS Detector
- Wavelength Range: 1um to 2.8um

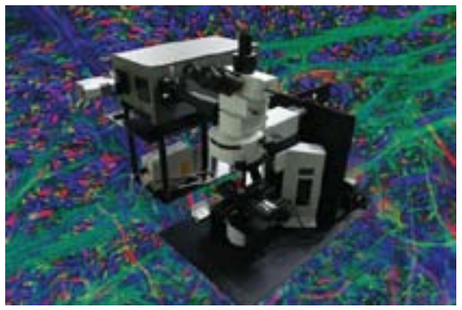
12. DAD-1602U, 16Bit AD/DA data acquisition set,
13.Monoworks, Data acquisition & processing software

System 9
UV-VIS-NIR Microscope Raman

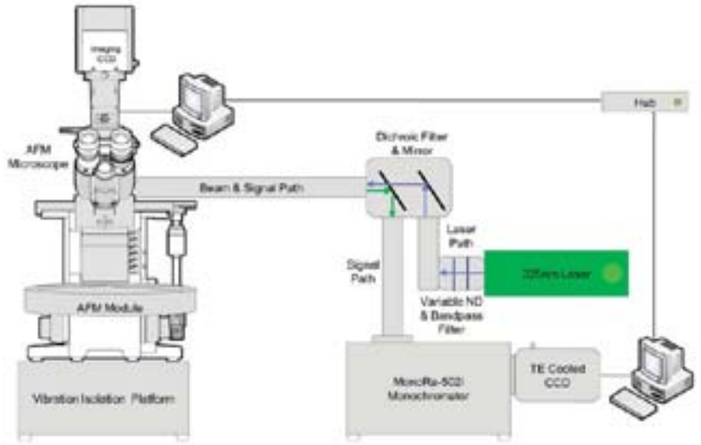


UV-VIS-NIR Macro Raman Measurement system

1. Source set
   A.FKL532.50.CWA.L 532nm Solid State Laser Set
   - Output power: 50mW TEM00
   B. LDM830100CWA 830nm Solid State Laser Set
   - Output power: 100mW TEM00
   C.IK3501R-G, 325nm HeCd laser set
   - Output power : 50mW Air cooled, Multi mode, 1.2mm beam dia.
2. Microscope System
   - 20x Objective Lens, working distance <31mm Depth of focal length +/- 3.5um
   - 50x M-Plane Objective Lens Depth of focal length +/- 1.6um
   - 50x Objective Lens, working distance >20mm
   - Spot size : 10 um when the wavelength used exceeds 1100 nm, the focusing position may slightly deviate
3. High Resolution Sample Chamber
   - CCD camera monitoring set w/Video capture board, 1600x
   - Vertical illumination for CCD monitoring
   - Laser Mirror for VIS(400-700nm)
   - 325 / 532 / 830nm Raman edge filter & Holder
   - 325 / 532 / 830nm Bandpass Filter w/holder for plasma line rejection
     Direct Optical interface for laser beam delivery
   - 100um optical fiber for signal beam delivery to spectrometer
4. MonoRa-512i Monochromator/Spectrograph
   - Resolution : 0.045nm @ 435.8 nm (1200gr/mm grating), 10 um slits
   - Focal length : 500mm,
   - Raman shift from 94Cm-1 to 1345Cm-1 with 1200gr/mm @532nm with 41 nm coverage
   - Raman shift from from 90Cm-1 to 3400Cm-1 with 1200gr/mm @325nm with 41 nm coverage
5. DV401A-BV CCD Detector
   - Sensor Option : Back illuminated CCD
   - Active Pixels : 1024x256



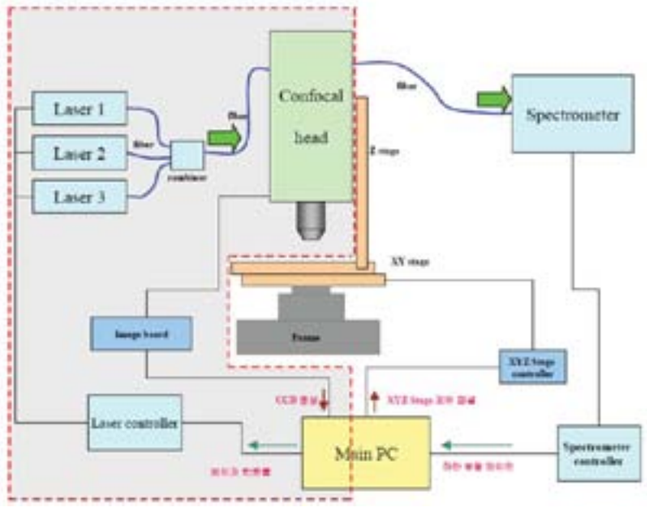
System 10
UV-VIS-NIR AFM-Raman



Ramboss Star-N Raman / AFM measurement system includes

1. Light source set
   A. IK3501R-G, 325nm HeCd laser set
   - output power : 50mW Air cooled, TEM00
   B. QUV266-50, 266nm diode pumped Qswitched laser set
   - Max average output power(quasi-cw) : 50mW
   - Pulse frequency : 1-100KHz(internal adjustable) 0-200KHz(external adjustable)
   - Pulse width : 10 ns to 20ns, adjustable from laser & rep.rate
   - Single mode, TEMoo, M2<1.3, typical M2<1.1
2. Detecting chamber
   Optical Path & alignment adjustable function with ND filter for Laser power control
   Raman Edge and Band pass filter set for 266 & 325 nm(to check the stokes line)
   Direct laser input and Raman signal input to spectrograph by Al mirror & beamsplitter
   A. MonoRa 512i, 500mm focal length high resolution spectrograph,
   - 500mm focal length multi-port monochromator/ spectrograph,.
   - Resolution: 0.05nm @435.8 nm (1200gr / mm grating), 10 um slits 0.12nm 1200gr / mm grating 0.08 nm with 1800 gr / mm / 10um slit / 1024 pixel CCD
   - Raman shift from from 305Cm-1 to 4000Cm-1 with 1200gr / mm @785nm with 41 nm coverage
   B. High performance TE cooled CCD detection set
   - Back-illuminated type CCD
   - Pixel format : 1024x128 pixels,
   - Spectral Range : 330-1050nm
3. AFM - Raman module
   A. MV 4000 SPM/NSOM/ Multi Probe System Probe and Sample Scanning
   - Scan Head Assembly: Up to 85 micron flat scanner piezo stage, incorporating:
   B. Labview based controller & software
   C. Tip/sample scanning controller
   D. MV4000 Interface Plate (two probe)
   E. Advanced Raman AFM/TERS/NSOM Integration Package
   F. Acoustic hood
   H. Raman Software Module
4. Additional Probe Tower :
   A. Additional probe tower assembly for MultiView4000
   B. Labview based controller & software

System 11
VECTOR-01FX True Confocal Raman



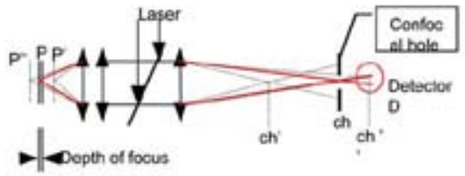
UV-VIS-NIR Macro Raman Measurement system

System Configuration
Confocal Raman system combines the benefits of the both Raman and Confocal technologies to achieve high quality Raman signal at the highest spatial resolution . Typically Confocal Raman system can be broken down into a number of modules and they are Laser, Confocal Microscope , Spectrometer, and Data Processing Unit. The Confocal Microscope includes a Confocal Aperture control unit, Objective Lenses, XYZ piezo stages, an Imaging CCD, an optional auto-focus module. Spectrometer includes a 500mm focal length imaging Monochromator and a high resolution CCD detector. Data Processing Unit includes a stage controller, a Laser Controller, and a high horse-power PC.

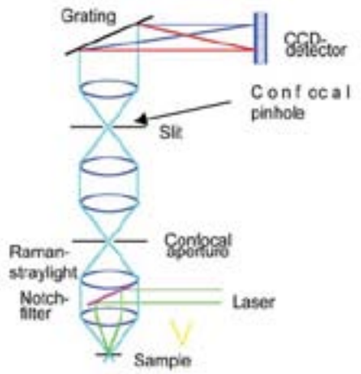
System Specification
1. Laser: 325 nm, 488 nm, 514 nm, 785 nm and optional (405, 473, 632, 830 nm)
2. Objective lens: 5X, 10X , 20X, 50X, 100X
3. N.A(Numerical Aperture:
   0.15, 0.30, 0.40, 0.55, 0.95
4. Lateral resolution: 140 nm @ 405 nm
5. Z axis range: 200 um (piezo stage scanner)
6. Positional repeatability: 20 nm
7. XY axis range: 80x80 mm
8. Optional auto focusing set
9. Positional repeatability:
   1 um step size, 3 um backlash
10. Spectral range: 50cm^-1 - 6000cm^-1
11. Lateral Spectral resolution:
    1.7 cm^-1 / CCD pixel @ 1200gr/mm grating
12. Microscope: Upright or Inverted type
13. CCD for sample monitoring
14. Optical unit:
    UV-VIS or UV-VIS-NIR(optional)

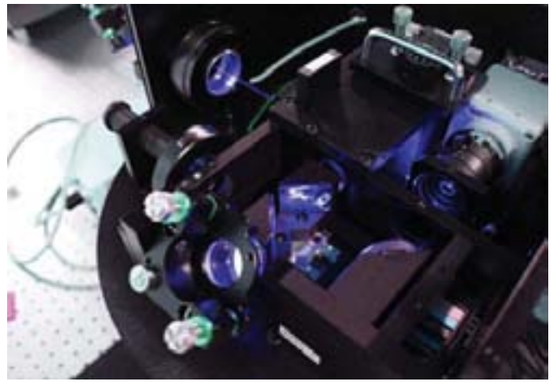
15. Image spectrometer
    - Focal length : 500 mm
    - Turret : triple grating
    - Input slit : one or two(optional)
    - Exit ports : 2 for CCD and PMT or APD(optional)
    - Slit width : 0-5 mm, 10 um via micrometer, 4-15 mm height
    - Motorized slit(optional)
    - Dispersion : 1.6 nm
16. Software: data acquisition and mapping in 2D / 3D, control of shutter, laser power, grating , center wavelength , and filter .
17. Raman library with spectra matching function

Confocal Raman
The key feature of Confocal microscopy is its ability to acquire in-focus images / spectrum from selected depths, a process known as optical sectioning. In a Confocal laser scanning microscope, a laser beam passes through a light source aperture and then is focused by an objective lens into a small (ideally diffraction limited) focal volume projected in the specimen layer by laser.
This allows to build a 3D profile of the scanned area. With Confocal and Raman techniques together forms a power tool in acquiring high resolution , Raman Images in 3D profile.
In terms of imaging resolution Confocal technology can be compared with SEM but is has advantage of not having physical probe.



The Confocal pinhole acts as an adjustable spatial filter allowing a careful and precise selection of the analyzed volume.





Product Features

Objectve Lens
VECTOR-001FX uses a 100x objective lens which is the only objective allowing to reach the highest spatial resolution of 1 micron in the visible range. It is optimized so that the highest flux which is collected and which enters the system is obtained when working with the highest spatial resolution.

Confocal Aperture
VECTOR-001FX uses a true Confocal aperture when some other systems are using only pseudo Confocal aperture. The true Confocal aperture allows to reach the highest spatial resolution removing all kinds of stray light generated by the molecules surrounding the volume to be analyzed.
Depending on the level of luminescence generated by these molecules a filtering at the level of the CCD detector is impossible as for high level of lights some charges can be transferred from pixel to pixel enlarging the size of the image on the detector and then reducing the spatial resolution.

Confocal Raman Principle
The energy from a point on the subject sample irradiated by a laser is focused on a Confocal hole and in turn is detected by a detector.
With the Confocal hole, only the energy generated by a point in the spotted plane is detected. If the energy is generated at the plane which is not focused on the Confocal hole, it is partially rejected and not detected.

Maple II
PL / PLE diagram

Light Sources

Xe Arc Lamp

250W Quartz Tungsten Halogen

Focusing Lens Set

Fiber optic illuminator

Monochromators

MonoRa150i

MonoRa200

Chambers

Micro/Macro PL Mapping Chamber

Low Temp. Cryo

Monochromators & Spectrographs

MonoRa320i

MonoRa500i

Detectors

PMT: PDS-1

Silicon SI-100-1

InGaAs: IGA-300-T2

LN Cooled MCT PbSe , PbS

2048 pixels Line CCD: DL-CCD-2048

CCD: iDus, Newton, Star

DPSS Lasers

Ar++ Lasers

HeCd Lasers

HeNe Lasers

PL/PLE System

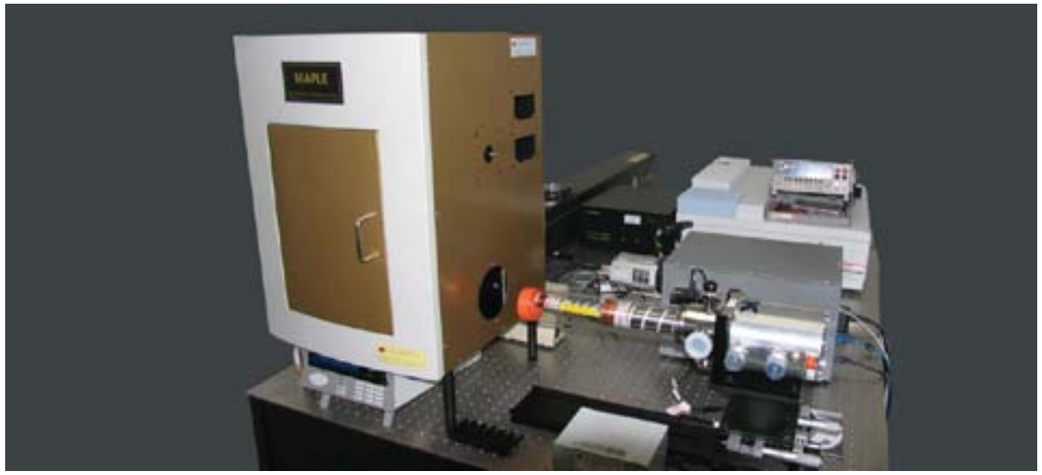
Maple II	Lasers + Maple Chamber + CCD Spectrograph (UV-VIS/InGaAs(NIR))
Maple HR	Lasers + Maple Chamber + MonoRa + Detectors (PMT/SI100/InGaAs/iDus)
Maple E	Lamp (450W Xe arc) + MonoRa + Maple Chamber + MonoRa + Detectors (PMT/Si/InGaAs/iDus) +
Maple HR-Cryo	Lasers + Maple Chamber + MonoRa + Detectors (PMT/Si/InGaAs/iDus) + Low Temp. Cryogenic system

HIGH QUALITY OPTICAL INSTRUMENTS & COMPONENTS FOR RESEARCH

Maple II

Photoluminescence system summary

"Maple II" High Performance P/L Mapping system



Features

- High performance & Low cost PL Mapping system
- Wide range extension(UV-VIS-NIR)
- Simple Design & Alignment
- Low noise and High PL signal detection
- Any Excitation Laser Source available
- Easy to find a peak and FWHM

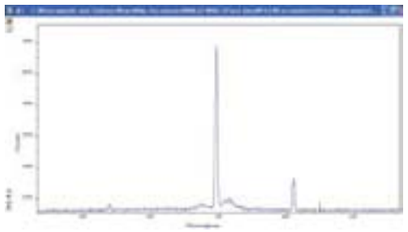
Applications

- General photoluminescence
- III-V materials Photoluminescence
- Fluorescence
- LD, LED Epi-wafer PL mapping

Specifications

- He-Cd Laser, 325nm, 25mW, TEM multimode
- High reflection dielectric mirror and holder
- Laser bandpass filter
- Fused silica lens set for focusing and collimating
- Cut-off filter set for laser line rejection
- Motorized XY stage set, 1um step resolution
- 2 &4 wafer sample holder
- Compact concave Holographic spectrograph
- 2048pixels, low noise array detector
- Detection range:200-1100nm(depends on grating)
- SMA905 connector, 100um dia., fiber optic interface
- includes system controller, control & Mapping
- Option for Thin film thickness measurement with white lightsource

325nm He-Cd Laser



Maple , P/L Mapping sample chamber

"Maple II" High Performance P/L Mapping system

Available Excitation Source

- 266nm UV laser (10mW-20mW)
- Ar-Ion Laser(488 and 514nm) 50-100mW
- DPSS Laser(532nm) 100-300mW
- He-Ne Laser(632.8nm) 20mW
- NIR Laser(785nm) 100mW

Available Detectors

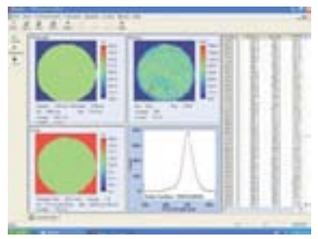
- Line CCD detector(2048pixels) 200-1000nm
- InGaAs Array detector(NIR512pixels) 900-1700nm
- High Performance & Low noise Cooled CCD detector(-75°C) (1024 x 128 or 1024 x 256 pixels)
- PMT detector set(190-900nm range)

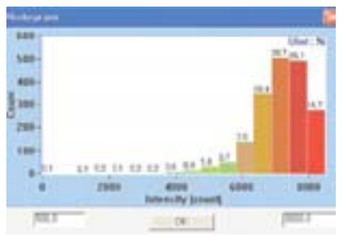
System spatial Resolution (TEMoo Mode)

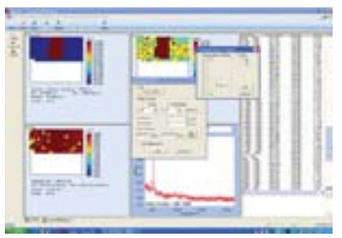
- 50um~100um(general purpose)
- 10um(10x M-plan lens)
- 1um step resolution with micro stepping motor stage
- Cryogenic system for Low Temp. PL, available upon request

Ordering Information

- Maple II : Lasers + Maple Chamber + CCD Spectrograph(UV-VIS/InGaAs(NIR))
- Maple HR : Lasers + Maple Chamber + MonoRa + Detectors (PMT/SI100/InGaAs/iDus)
- Maple E : Lamp (450W Xe arc) + MonoRa + Maple Chamber + MonoRa + Detectors (PMT/Si/InGaAs/iDus) +
- Maple HR-Cryo : Lasers + Maple Chamber + MonoRa + Detectors (PMT/Si/InGaAs/iDus) + Low Temp. Cryogenic system

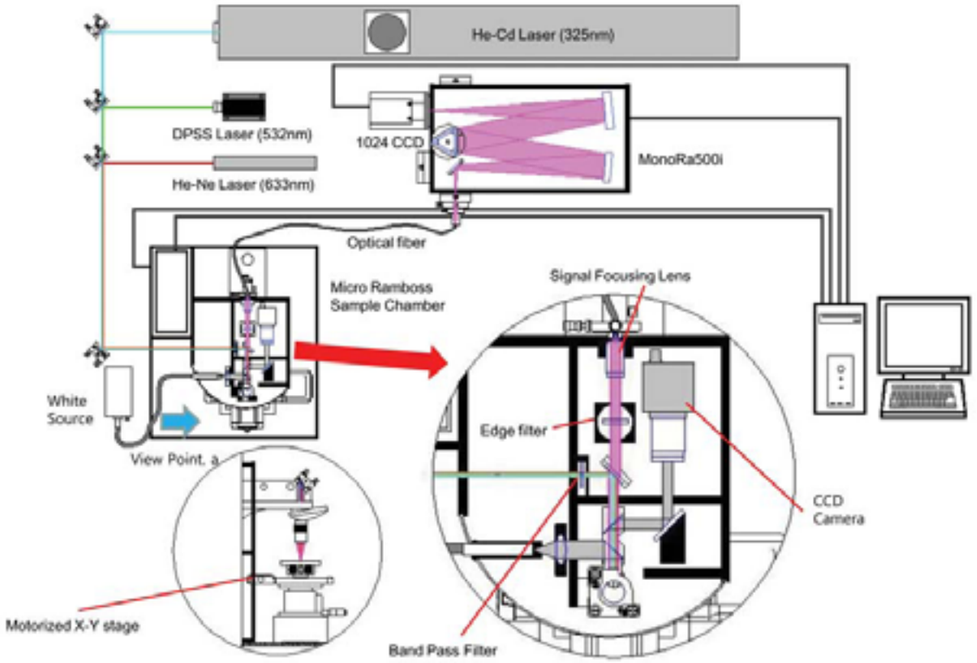




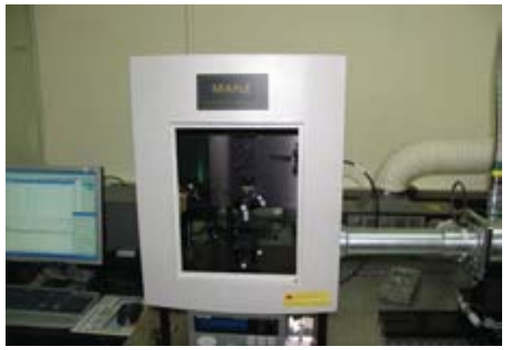


System 12

Maple II, UV-VIS-NIR Micro PL Mapping



MAPLE-II, Micro/Macro PL Mapping system



1.Excitation Laser source
- a) IK3202R-D, 25mW, 325nm HeCd laser set
- b) 532nm, 100mW DPSS laser set
- c) LDM830100CWA 830nm Solid State Laser Set
- Output power: 100mW TEM00

2. Maple sample Chamber
- UV-NIR Objective lens
- Holed mirror for Laser beam & PL signal path
- Iris Diaphragm set for laser beam alignment
- Includes manual shutter and variable ND filter
- Laser line bandpass & cut-off filter set
- Manual stage set for sample
- 2”, 3”, 4” Epi-Wafer sample holder plate with vacuum chuck.

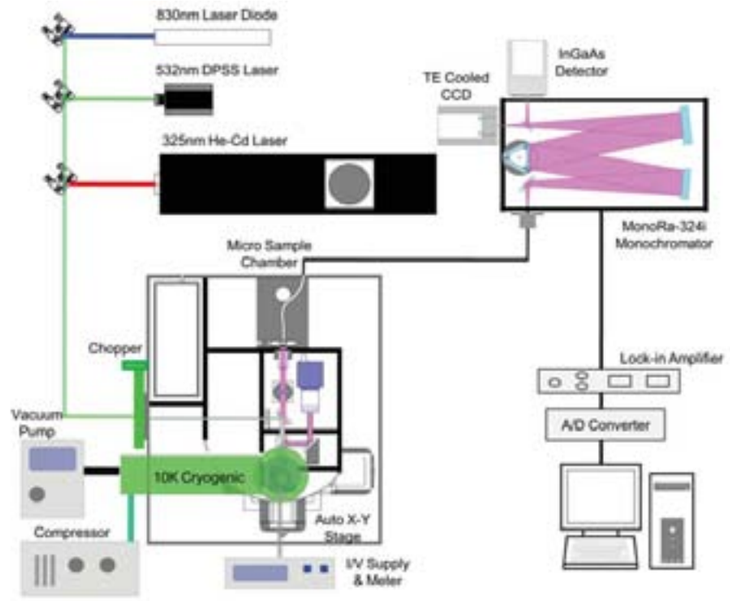
3. Monor320i, 320mm focal length monochromator/spectrograph
- Resolution : 0.09nm @ 435.8 nm (1200gr/mm grating), 10 um slits
- Focal length : 320mm,

4.UV enhanced TE Cooled CCD detector set for 200-1000nm
- 1024x256 pixels, Back-illuminated
- Minimum operating Temp : -70°C / TE cooled
- Spectral wavelength range : 200-850 nm

5.IGA-030-TE2, 2 Stage TEC InGaAs Detector for 800-1700nm
- Wavelength Range : 800nm to 1700nm

System 13

UV-VIS-NIR AFM-Raman



UV-VIS-NIR Cryostat Micro PL EL measurement system

1.Excitation Laser source
- a) IK3202R-D, 25mW, 325nm HeCd laser set
- b) 532nm, 100mW DPSS laser
- c) LDM830100CWA 830nm Solid State Laser Set
- Output power: 100mW TEM00

2. Maple sample Chamber
- UV-NIR Objective lens
- Holed mirror for Laser beam & PL signal path
- Includes manual shutter and variable ND filter
- Laser line bandpass & cut-off filter set
- Manual stage set for sample
- 2”, 3”, 4” Epi-Wafer sample holder plate with vacuum chuck.

3. Monor320i, 320mm focal length monochromator/spectrograph
- Resolution: 0.09nm @ 435.8 nm (1200gr/mm grating), 10 um slits
- Focal length: 320mm,

4. UV enhanced TE Cooled CCD detector set for 200-1000nm
- 1024x256 pixels, Back-illuminated CCD
- Minimum operating Temp : -70°… / TE cooled
- Spectral wavelength range : 200-850 nm

5. IGA-030-TE2, 2 Stage TEC InGaAs Detector for 800-1700nm
- Wavelength Range: 800nm to 1700nm

6.10k Cryostat system includes the following:
- Helium Compressor - ARS-2HW
- Temperature Controller Model SI-9700-1,
- INCLUDED EXTRA 4 X COPPER LEAD for electrical experiment

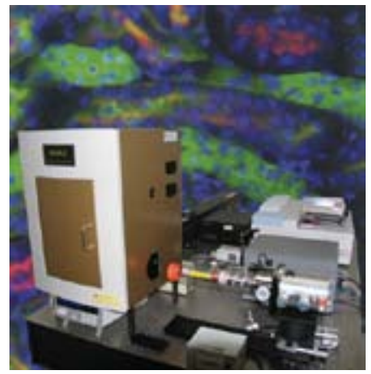
7. 2400 source meter and clip on test lead

8. DAD-1602U, 16Bit AD/DA data acquisition board, USB interface

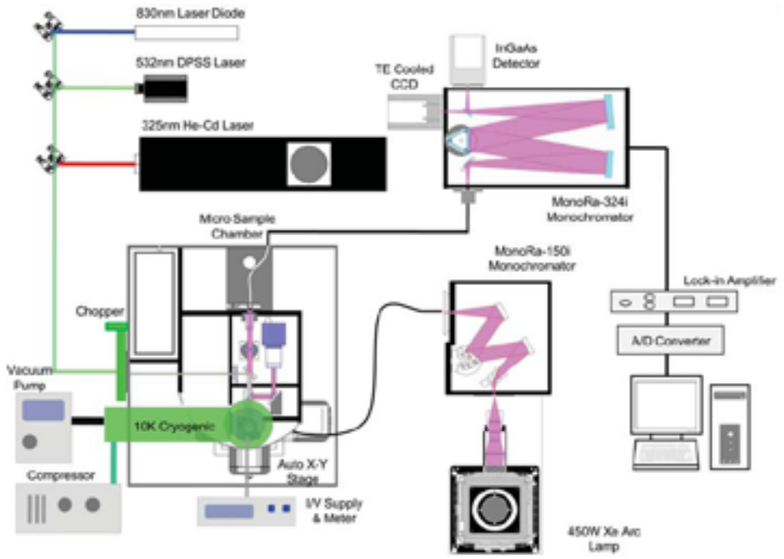
9. Monoworks, Data acquisition & processing software

10. M300CD, Digital Display Chopper

11. M410, Single Phase Lock-in Amplifier



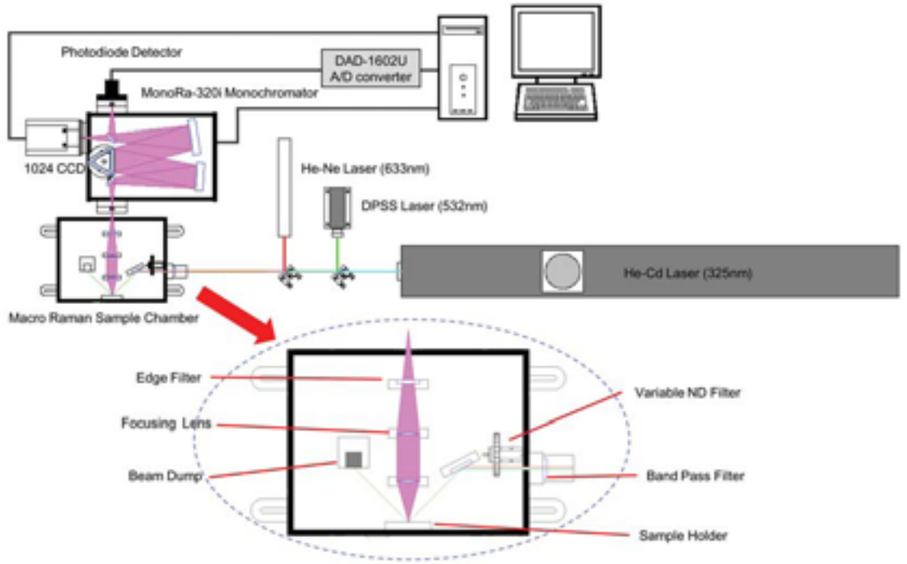
System 14
UV-VIS-NIR Macro Cryo PL + PLE



UV VIS NIR Cryostat PL+PLE Measurement system

1. A.532nm DPSS Excitation Laser source
   - 100mW, TEMoo Mode
   B.LDM830100CWA 830nm Solid State Laser Set
   - Output power: 100mW TEM00
   C. IK3202R-D, 25mW, 325nm HeCd laser set
2. MonoRa201, 200mm focal length monochromator
   - Resolution: 0.18nm @ 435.8 nm (1200gr/mm grating), 10 um slits
   - Focal length: 200mm.
3. DL300-XE, 300W Xe arc Lamp set
   - spectral range : 260-2000nm, ozone free lamp
4. DL250-TH. 250W Tungsten Halogen Light Source
5. OSF-6, Manual Order sorting filter wheel assembly
6. SC500, Fluorescence Sample Chamber with IN/OUT Mount
   - 30mm dia., Fused Silica lens, Biconvex, 3pcs included for 3 ports
   - cryo sample port
7. DM324i, 320mm focal length monochromator / spectrograph
   - Resolution: 0.09nm @ 435.8 nm (1200gr/mm grating), 10 um slits
   - Focal length: 320mm,
8. S / IGA-025/020-TE2, Two color Sandwich detector Si, 2.5mm dia. InGaAs, 2mm dia. active area 300-1000nm(Si) & 1000nm to 1700nm(IGA) detection range
9. PDS-01, PMT Detector Assembly Incl. Universal Photomultiplier Tube Housing for standard 1.125" side window PMT 4 digit LCD display, HV/signal switch includes 0-1200V HV power supply. PMT-955,Hamamatsu R955 side window photomultiplier tube, 185-930nm, High efficiency
10. DAD-1602U, 16Bit AD/DA data acquisition set,
11. Monoworks, Data acquisition & processing software
12. PBS-020-TE2. two Stage TEC PbS Detector
    - Wavelength Range : 1um to 2.8um
    - Active Area : 2mm dia.
13. M300CD, Digital Display Chopper
14. M410, Single Phase Lock-in Amplifier
15. 10k-550k Complete system includes the following:
    - Displex Cryocooler - DE-202 with Bolt On Skirt
    - Helium Compressor - ARS-2HW

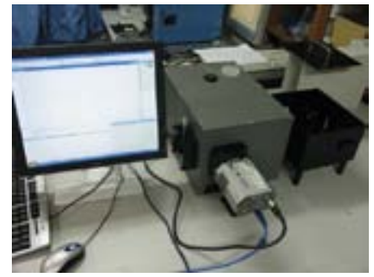
System 15
UV-VIS-NIR Macro PL



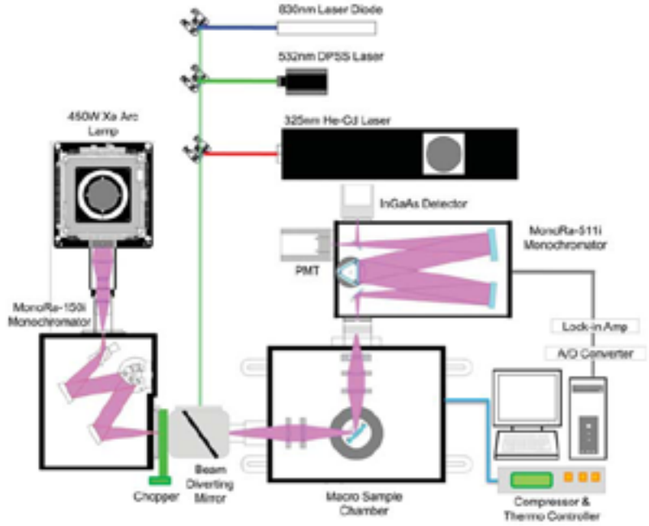
UV-VIS-NIR Macro PL Measurement system

UV-VIS-NIR Macro PL Measurement system

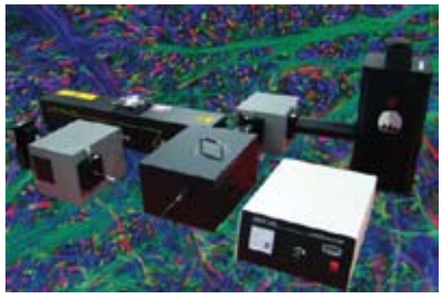
1. Excitation Laser source
   a) IK3202R-D, 25mW, 325nm HeCd laser set
   - Air cooled, TEM multi mode, 1.6mm beam dia.,
   b) 532nm DPSS Excitation Laser source
   - Low noise 532nm DPSS laser 100mW, TEMoo Mode
   c) LDM830100CWA 830nm Solid State Laser Set
   - Output power: 100mW TEM00
2. Macro PL Sample Chamber
   - Includes 30mm dia., Fusedsilica PL / CX lens,
   - Variable ND filter, Bandpass & cutoff filter
   - Sample holder, rotation & translation stage set
3. Monor320i, 320mm focal length monochromator / spectrograph
   - Resolution: 0.09nm @ 435.8 nm (1200gr / mm grating), 10 um slits
   - Focal length: 320mm,
4. IGA-030-TE2, 2 Stage TEC InGaAs Detector
   - Wavelength Range: 800nm to 1700nm
5. PDS-01, PMT Detector Assembly Incl. Universal Photomultiplier Tube Housing for standard 1.125" side window PMT 4 digit LCD display, HV/signal switch includes 0-1200V HV power supply. PMT-928 Hamamatsu R928 side window photomultiplier tube, 185-900nm



System 16
UV-VIS-NIR Macro PL + PLE

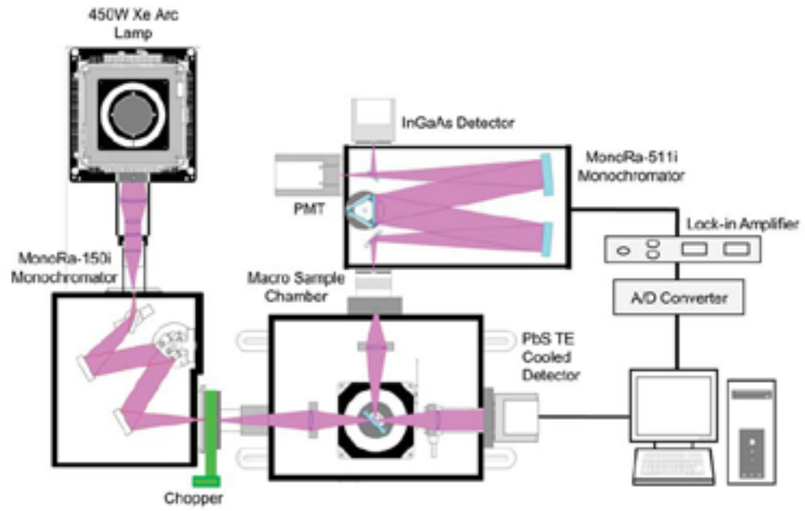


UV VIS NIR Macro PL / PLE measurement system

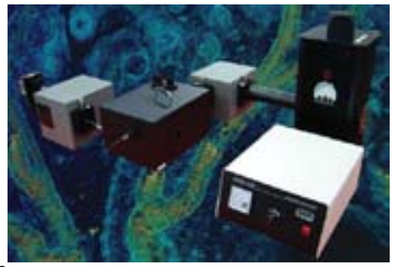


1. Excitation source
   A. LS300T, Air cooled Ar-ion laser set
   - 488nm @ 100mW / 514nm @100mW / TEMoo mode
   B.LDM830100CWA 830nm Solid State Laser Set
   - Output power: 100mW TEM00
   C. IK3202R-D, 25mW, 325nm HeCd laser set
2. DL150-XE 150W Xe arc Lamp set
   150W Xe arc Lamp
   150W Xe lamp with vertical type lamp housing spectral range :
   200-2000nm, ozone generation lamp
3. MonoRa151i, 150mm focal length monochromator
   - Resolution : 0.2nm @ 435.8nm
   (1200gr/mm grating), 10 um slits
   - Focal length : 150mm,
4. Sample Chamber
   Includes 50mm dia., Fused silica PL/CX lens, Beamsplitter / 488 / 514 / 830 nm laser line filter & long pass filter
5. MonoRa511i, 500mm focal length multi-port monochromator,
   - Resolution: 0.05nm @ 435.8 nm
   (1200gr/mm grating), 10 um slits
   - Focal length: 500mm,
6. M420, Dual Phase Lock-in Amplifier
7. M300CD, Digital Display Chopper
8. S/IGA-025/020-TE2, Two color Sandwich detector
   Si, 2.5mm dia. InGaAs, 2mm dia. active area 300- 1000nm(Si) & 1000nm to 1700nm(IGA) detection
   range
9. PDS-01, PMT Detector Assembly 4 digit LCD display, HV/signal switch includes 0-1200V HV power supply.
   PMT-955,Hamamatsu R955 side window photomultiplier tube, 185-930nm,
10. DAD-1602U 16Bit AD/DA data acquisition set, USB
    interface, stand alone type

System 17
UV-VIS-NIR Macro PLE + Fluorescence

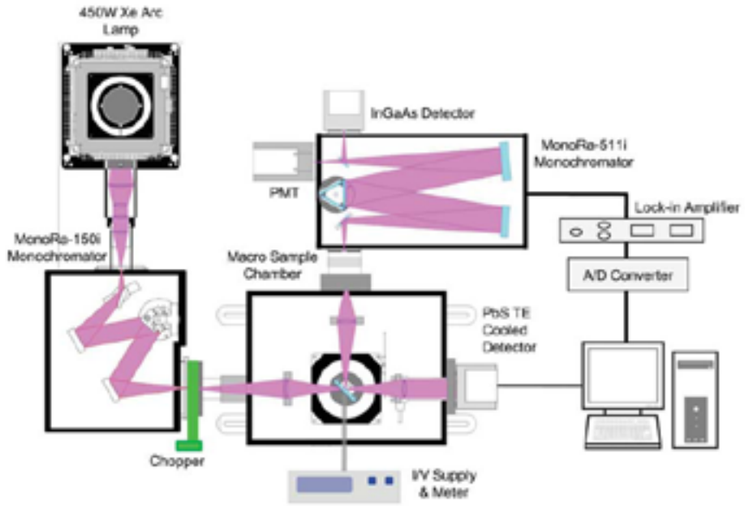


UV VIS NIR Macro PLE / Fluorescence measurement system



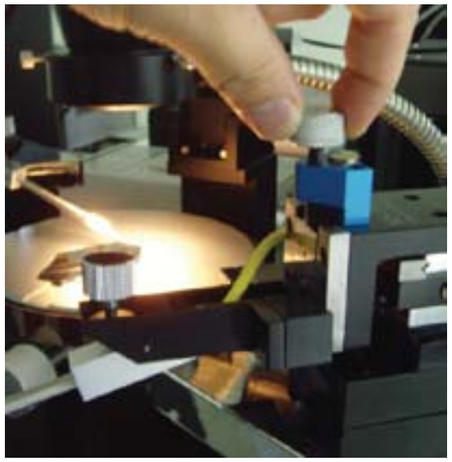
1. DL150-XE 150W Xe arc Lamp set
   150W Xe lamp with vertical type lamp housing
   spectral range : 350-2000nm, ozone generation lamp
2. MonoRa151i, 150mm focal length monochromator
   - Resolution : 0.2nm @ 435.8nm (1200gr/mm grating), 10 um slits
   - Focal length : 150mm,
3. PLE Sample Chamber
   Includes 50mm dia., Fused silica PL / CX lens, Beamsplitter
   Included ND filter set (4 from OD 1.3 to 3.0 ,200-700 nm range)
   long pass filter (transmission : 368.5 - 820.6 nm)
   motorized rotation stage and sample holder set
4. MonoRa324i, 320mm focal length monochromator/spectrograph
   - Resolution: 0.09nm @ 435.8 nm (1200gr/mm grating), 10 um slits
   - Focal length: 320mm,
5. M420, Dual Phase Lock-in Amplifier
6. M300CD, Digital Display Chopper
   Chopping head, cable and 4 chopping disks included.
7. S/IGA-025/020-TE2, Two color Sandwich detector
   300-1000nm(Si) & 1000nm to 1700nm(IGA) detection range
8. PDS-01, PMT Detector Assembly
   4 digit LCD display, HV/signal switch includes 0-1200V HV power supply.
   R955 side window photomultiplier tube, 185-930nm, High efficiency
9. PBS-020-TE2. two Stage TEC PbS Detector
   - Wavelength Range: 1um to 2.8um
10. DAD-1602U 16Bit AD/DA data acquisition set, USB interface, stand alone type

System 18
UV-VIS-NIR Macro PLE + EL



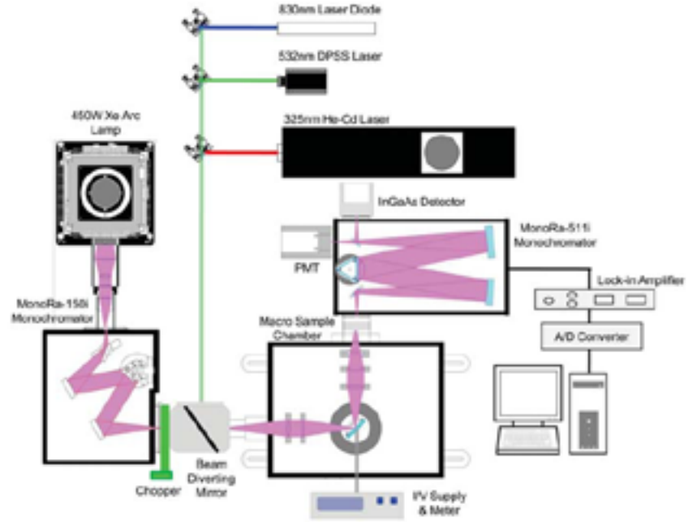
UV-VIS-NIR Macro / PLE / EL measurement system

1. DL450-XE, 450W Xe arc Lamp set
   Spectral range : 260-2000nm, ozone free lamp
2. MonoRa151i, 150mm focal length monochromator
   - Resolution : 0.2nm @ 435.8nm (1200gr/mm grating), 10 um slits
   - Focal length : 150mm,
3. Sample Chamber
   Includes 50mm dia., Fused silica PL / CX lens, Beamsplitter Included ND filter set (5 from OD 1.3 to 3.0 ,200-700 nm range, 30 mm dia)
   Filter wheel set
   MOSF-6, Motorized Order sorting filter wheel assembly, installed DC probe holder with micrometer controller, Probe tip 2 set Vacuum chuck set to hold a sample.
   Digital sour cemeter & test lead set
   Manual stage to control a sample position
4. MonoRa 320i MonoRa323i, 320mm focal length multi port monochromator,
   - Resolution: 0.09nm @ 435.8 nm (1200gr/mm grating), 10 um slits
   - Focal length: 320mm,
5. M420, Dual Phase Lock-in Amplifier
6. M300CD, Digital Display Chopper
7. PBS-020-TE2, 2 Stage TEC PbS Detector
   Wavelength Range: 1um to 2.8um
8. PDS-01, PMT Detector Assembly for calibration
   - 4 digit LCD display, HV/signal switch includes 0-1200V HV power supply.
   - R928 side window photomultiplier tube, 185-900nm



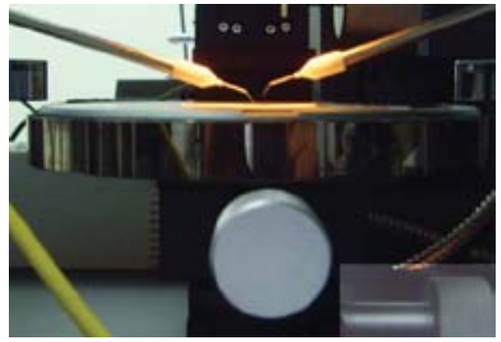
10. DAD-1602U 16Bit AD/DA data acquisition set, USB interface, stand alone type
11. Monoworks-T Data acquisition & processing software for MonoRa series Monochromator

System 19
UV-VIS-NIR Macro PL + PLE + EL



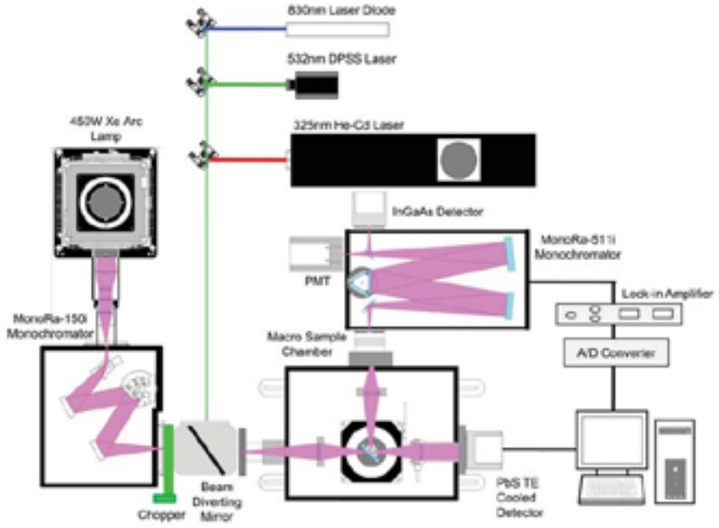
UV-VIS-NIR Macro / PL / PLE / EL measurement system

1. A. LS300T, Air cooled Ar-ion laser set\ 488nm 100mW / 514nm 100mW / TEMoo mode
   B. LDM830100CWA 830nm Solid State Laser Set
   - Output power: 100mW TEM00
   C. IK3202R-D, 25mW, 325nm HeCd laser set
   - Air cooled, TEM multi mode, 1.6mm beam dia.,
   D. DL450-XE, 450W Xe arc Lamp set
   - Spectral range : 260-2000nm, ozone free lamp
2. MonoRa151i, 150mm focal length monochromator
   - Resolution : 0.2nm @ 435.8nm (1200gr/mm grating), 10 um slits
   - Focal length : 150mm,
3. PL/PLE/EL Sample Chamber
   Includes 50mm dia., Fused silica PL/CX lens, Beamsplitter Included ND filter set (5 from OD 1.3 to 3.0 ,200-700 nm range, 30 mm dia)
   Filter wheel set
   MOSF-6, Motorized Order sorting filter wheel assembly, installed DC probe holder with micrometer controller , Probe tip 2 set Vacuum chuck set to hold a sample.
   Digital source meter & test lead set
   Manual stage to control a sample position
4. MonoRa 320i MonoRa323i, 320mm focal length multi port monochromator
   - Resolution: 0.09nm @ 435.8 nm (1200gr/mm grating), 10 um slits
   - Focal length: 320mm,
   - Included Hg lamp set



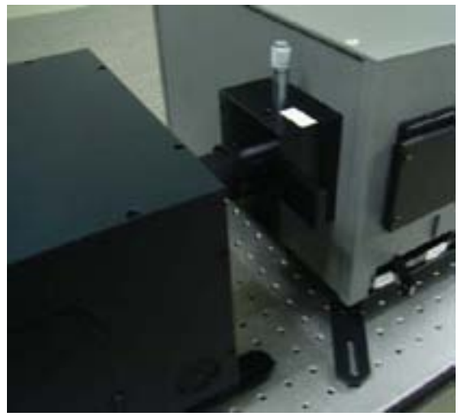
5. M420, Dual Phase Lock-in Amplifier
6. M300CD, Digital Display Chopper
7. PBS-020-TE2, 2 Stage TEC PbS Detector
   Wavelength Range: 1um to 2.8um
8. PDS-01, PMT Detector Assembly for calibration
   - 4 digit LCD display, HV/signal switch includes 0-1200V HV power supply.
   - Hamamatsu R928 side window photomultiplier tube, 185-900nm
9. DAD-1602U 16Bit AD/DA data acquisition set, USB interface, stand alone type
10. Monoworks Data acquisition & processing software for MonoRa series Monochromator

System 20
ATR & PLE Measurement



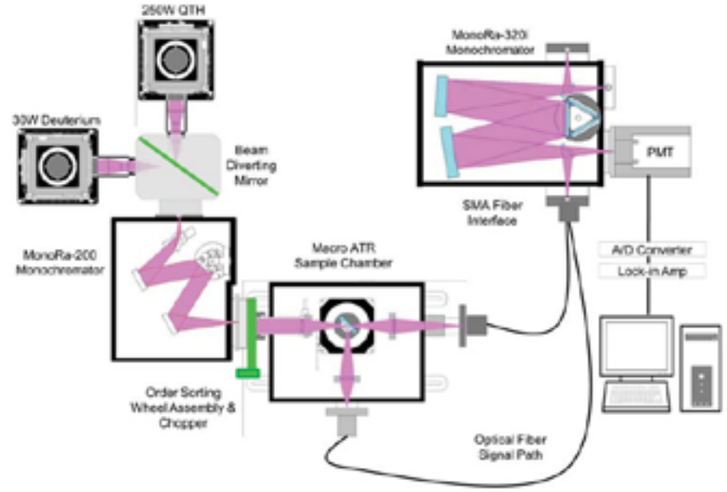
UV VIS NIR Macro PL / PLE / ATR measurement system

1. Excitation source
   A. LS300T, Air cooled Ar-ion laser set
   - 488nm 100mW / 514nm 100mW / TEMoo mode
   B. LDM830100CWA 830nm Solid State Laser Set
   - Output power: 100mW TEM00
   C. IK3202R-D, 25mW, 325nm HeCd laser set
   - Air cooled, TEM multi mode, 1.6mm beam dia.,
2. DL150-XE 150W Xe arc Lamp set
   - 150W Xe arc Lamp
3. MonoRa151i, 150mm focal length monochromator
   - Resolution : 0.2nm @ 435.8nm (1200gr/mm grating), 10 um slits
   - Focal length : 150mm,
4. Sample Chamber
   - Includes 50mm dia., Fused silica PL/CX lens, Beamsplitter Included ND filter set (4 from OD 1.3 to 3.0 ,200-700 nm range) /488/514/830 nm laser line filter & long pass filter (transmission : 368.5 - 820.6 nm) Included beam diverter set for laser source
5. MonoRa511i, 500mm focal length multi-port monochromator,
   - Resolution: 0.05nm @ 435.8 nm (1200gr/mm grating), 10 um slits
   - Focal length: 500mm,
6. M420, Dual Phase Lock-in Amplifier
7. M300CD, Digital Display Chopper
8. S/IGA-025/020-TE2, Two color Sandwich detector



   - 300-1000nm(Si) & 1000nm to 1700nm(IGA) detection range
9. PDS-01, PMT Detector Assembly
   - 4 digit LCD display, HV/signal switch includes 0-1200V HV power supply.
   - PMT-955,Hamamatsu R955 side window photomultiplier tube, 185-930nm, High efficiency
10. PBS-020-TE2. two Stage TEC PbS Detector
    - Wavelength Range: 1um to 2.8um
11. DAD-1602U 16Bit AD/DA data acquisition set, USB interface, stand alone type

System 21
ATR Measurement



ATR measurement system

1. Monochromatic light source :
   A.DL030-D2, 30W Deuterium lamp set
   - Includes, 30W Deuterium lamp (180-650nm range), Lamp Housing,
   - Secondary focusing lens includes lamp power supply for 30W D2 lamp.
   B. DL250-TH. 250W Tungsten Halogen Light Source
   - Provides output from 350nm to>2.0um.
   C. Beam diverter box set
   D. MonoRa201, 200mm focal length monochromator
   Resolution: 0.18nm @ 435.8 nm (1200gr/mm grating), 10 um slits Focal length: 200mm.
   E.OSF-6, Manual Order sorting filter wheel assembly Includes 6 holes filter wheel w/5 cut-off filters
2. Fluorescence / ART Sample Chamber with IN/OUT Mount 25mm dia., Fused Silica lens, Biconvex, 3pcs included(please specify focal length)
   Adjustable sample holder.(cuvette cell or wafer),reference cell and cutoff filter & filter holder Manual Rotation sample holder for angle scan with 0.1 degree resolution
3. Detecting set
   A. MonoRa 321i, 320mm focal length monochromator, adjustable entrance and exit slit.
   Resolution: 0.09nm @ 435.8 nm (1200gr/mm grating), 10 um slits5

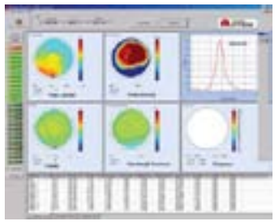
   Focal length: 320mm,
   B.PDS-01, PMT Detector Assembly
   - 4 digit LCD display, HV/signal switch includes 0- 1200V HV power supply.
   - Hamamatsu R928 side window photomultiplier tube, 185-900nm C.XYZ position control stage set for input signal to monochromator
   Included 1 mm core fiber and focusing assembly set(1ea)
4. DAD-1602U, 16Bit AD/DA data acquisition set,
5. Monoworks, Data acquisition & processing software

TSC
www.toptical.com.tw 02-2346-1510 toptical@ms17.hinet.net

System 24
Maple-X PL Mapping

MAPLE-X (High Speed Photoluminescence Mapping)

S/W
- Integrated mode for high speed mapping
- Spectral mode with PL intensity, peak, FWHM
- Thickness mode for the measurement of thin film
- Display option for 2D & 3D
- Easy control with your recipe
- Supporting recipe files and recipe editor



Features
- High performance & Low cost PL Mapping Wide extension wavelength range (UV-VIS-NIR)
- Compact design & high resolution Any excitation laser source available Thin film thickness measurements
  High speed
  Automatic system(For the mass-production)

Applications
- General photoluminescence
- III-V materials photoluminescence
- Fluorescence
- LD, LED Epi-wafer PL mapping

H/W
- Resolution : 0.1mm
- Speed : 25min. / cassette(25pcs) / 2 /2mm
- Real-Time laser power monitoring
- Programmable excitation laser power control
- Size available from 2 - 8 inches
- High precision repeatability using pre-aligner
- 2 Loading / Unloading cassette
- Touch screen monitor interface

Specifications

1. Spectrometer
- Wavelength range : 200nm -1,100nm(UV-VIS-NIR)
- Detector : Low noise CCD linear array, 2048 pixels

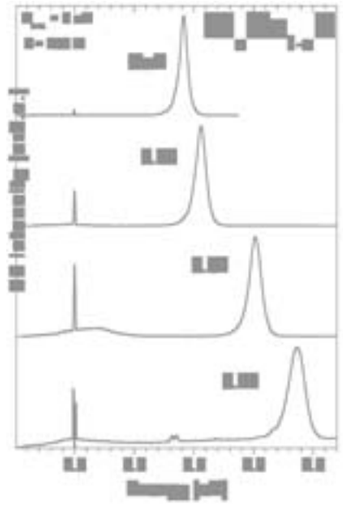
2. Laser
- Laser source : 266nm, 325nm, 375nm, 405nm, 442nm,
- 532nm, 658nm, 785nm
  (Any kind of laser sources available)

3. Thin film thickness measurements
- Thickness : 10nm - 50um, 1nm resolution
- Light source : Deuterium-halogen light source

4. Auto loading/unloading/Aligner
- Wafer size : 2 , 4 6 , 25pcs cassette package
  (8 wafer size optional)

Wide Bandgap MiniPL Spectrometer

Fully integrated with excitation energy up to 5.5 eV



Features

- Room Temperature PL
- 5.5(224nm) or 5.0 eV(248.6nm) laser excitation
- measurement of excitation and emission energy for direct QE measurement
- Highly portable 15 x 18 x 36cm,<8Kg
- High Resolution 0.2nm (multi slits included).
- Computer controlled Grating selection and Calibration
- 1200ln Grating std. (300nm peak)
- 3600ln Grating for High Res PL or Raman optional (250nm peak)
- Digital PMT controller with gated box car Integrator & Averager for low noise digital PMT output measurement
- < 20Watts (90-240VAC) input
- Fully integrated, self contained, system
- LabView interface and control of laser, spectrograph, PMT, spectral data
- Analysis software included, FWHM, Peak, Side lobe identification, spectral subtract, normalize etc.
- Up to 50 mm diameter sample size
- X-Y-Z stage manual sample control 50mm standard
- 50mm X-Y motorized stage including mapping software optional.

Measurement of photoluminescence (PL) spectra from semiconductor materials is an important characterization method and is widely accepted for providing information on carrier doping levels, alloy composition, bandgap and edge effects, etc. These measurements are important both for research, device characterization and process monitoring.

Photon Systems Deep UV (DUV) MiniPL Spectrometer provides the most compact and inexpensive instrument available at these wavelengths. Enabling PL spectra measurement of semiconductor materials with bandgap up to about 5.5 eV corresponding to AlGaN with Al concentrations up over 80%.

System Configuration The Photon Systems DUV Mini-PL system in a completely integrated digital instrument with selfcontained deep UV laser, monochromator, detector, optics and electronics.

Laser 224nm (5.5 eV) or 248nm (5.0 eV) laser with self-contained laser power supply/controller.

Monochromator 1/8M Czerny-Turner configuration with 2 gratings: 1200g/mm (0.7 nm resolution, and 3600g/mm (0.2 nm resolution optional)

Detector 190nm to 650nm PMT; 1-106 gain, computer adjustable

Optics Reflective objective, laser line filter, injection filter

Data acquisition Digital control of laser, PMT and spectrometer with digital gated boxcar integrator and averager. Fully calibrated to display detected photons versus wavelength, Wavenumber, photon energy.

Software LabView 8.2

Diagram of System