Raman Reflex
Last Updated: 12/8/2020

You must be a “Qualified Self-User” to operate this instrument independently. You must be on the labs “Instrument Reservation Schedule” before touching the instrument for any reason. Any problems, STOP, Post a note on the instrument and send an email to mtim@mit.edu immediately.
Do not perform any maintenance.
Do not install any software
Do not adjust any optics.

**Instrument Hazards:**
Lasers, Cryogenic Liquids Chemicals & Electricity.

**Laser Safety:**
Anyone operating the laser must have attended the MIT Radiation Protection Offices Laser Safety Training. Call X2-EHSS to schedule a class.
Lasers: Class 3B, Interlocked system (No exposed laser beams).
Wavelength and Power: 785nm 100mw, 533nm 50mw, 437nm 25mw.

**Required Apparel:**
Safety Glasses
Laser Safety Glasses when interlocks are disabled.
Wear clean gloves when handling optics.

**CORAL:**
Engage the instrument using CORAL when you enter the lab.
Disengage CORAL when you are leaving the lab.
Report all problems immediately to mtim@mit.edu.
Check out the system when you arrive:
If you encounter any problems: Stop work and send Tim (mtim@mit.edu) an email immediately.
Lasers, Spectrometer and Microscope Laser Safety Enclosures – Closed.
Computer – On
Software - Closed.

Operation:
Turn the Lasers on (Key).
785nm laser must warmup ~ 30 seconds before performing health check.

Logon to computer:
User name: Admin
Password: 134139
Open the raman software: “Wire”.

Verify Performance:
On the machine status toolbar:
Choose your desired Laser Wavelength & Grating.
(1200 l/mm and 2400 l/mm installed, 600 l/mm available.)

Run the Health Check
- 473nm & 532nm – Regular or Confocal
- 785nm – Line Focus
Do not do any alignments unless health check requires it.
Do the alignment or quick calibration if prompted by the health check.
If the results tell you to do an alignment or quick calibration you will find this under the “Tools” menu.
Confocal Note:
The Raman Microscope is inherently Confocal because it has two pinholes in the beampath.
To optimize the confocality of the system the laser beamsize is adjusted to the size of the backplane of the microscope objective you are using.
When you create a new spectral acquisition measurement file you will find two options.
Regular or High Confocal.
Regular – Illuminates 13 rows of pixels on the ccd.
High Confocal – only reads the center row of pixels.
High confocal is a way of collecting data from a thinner slice of your sample. If high confocal is selected anything not in focus won’t be read by the ccd.
Perform your work:

Save your data:
Walk away with a copy of your data if it is important to you.
Use a USB thumb drive to transfer your data.
Do not connect to the Q drive!

Data Analysis:
Wire software is available to users.
Available on the desktop of the Raman computer.
Follow the readme instructions.
**Shutdown at end of session:**
Close the Software
Turn off the Lasers (Key)
Cleanup
Disengage CORAL

**Problems?**
Send mtim@mit.edu an email immediately.
It is OK to try to resolve the problem by restarting the system.

**Restart the system:**
Restart the Computer.
Turn the Main Power Off then back on (Located on the back of the spectrometer).
Open the software (Wire).
Initialize the motors if needed.
Turn on the Lasers (Key).
There is also a power switch to the Raman spectrometer that is not normally turned off.
The power switch is located on the back of the spectrometer (facing the wall).

**Interlock tripped?**
Close the Spectrometer and Sample compartment doors.
Reset the interlock in the software under the Tools menu.
Turn the laser off and back on using the key.

**Utilities:**
Electricity (wall).

**Emergency Shutdown:**
Shutdown the computer.
Turn off the spectrometer power.
Power switch is located on side of the spectrometer facing the wall.

**Restart after an emergency:**
Restart the computer.
Turn son the spectrometer power.
Power switch is located on side of the spectrometer facing the wall.
Raman Polarization Measurement Configuration Modes

Polarized – ½ lambda waveplate - Linear
Depolarized – ¼ lambda waveplate - Circular

Isotropic Samples
Depolarized Raman
   Incident – Depolarized
   Analyzer – Polarized X or Y

Anisotropic Samples
Polarized Raman
   Incident – Polarized X and Y
   Analyzer – Polarized X and Y
   Rotatable Sample Stage

Angle Resolved Polarized Raman
   Incident – Linear Polarized (1/2 waveplate) X and Y
   Analyzer – Linear Polarized (1/2 Waveplate) 0-190 degrees
   Rotatable Sample Stage

In the measurement setup under the advanced tab you can choose to put a polarizer into the excitation beam path. Either circular or linear.
Remember sample orientation will usually make a difference.
Measuring a piece of silicon at different orientations is a good example of this.
There is a rotatable stage insert that could be used.

The 532nm laser has a computer controlled polarizer (1/2 Lambda Waveplate).
Note: 60 degrees = 0 degrees, operates from 60 deg to 400 deg.
Pol orientation on sample stage: 100 degrees = Y, 190 degrees = X

To use the computer controlled 532nm polarizer:
Find the “Setup Polarization Measurement” under one of the menu dropdown list.
To run the experiment choose “Run Polarization Measurement” under the same menu dropdown list.
When finished – Reset the polarizer to 60 degrees.

If you have a problem with the polarizer covering your measurement range or you need a polarizer in the collection path
there are wavelength specific polarizers that can be manually placed in the Excitation and Collection paths. Circular or Linear.
532nm Low Wavenumber Filter (LWNF)
You must be trained by Tim to specifically use this filter.
Wear Gloves, Laser Safety Glasses

Open Spectrometer Cover.
Remove 532nm Edge Filter.
Install 532nm LWNF.
Setup Experiment for 1 second exposure, 100% Power and 1 Accumulation, 2400 grating, range centered at zero.
Focus microscope onto Silicon or Sulfur Reference sample.
Click the “Cycle” icon.
Adjust the slit until you maximize sample signal and minimize laser signal (Counter Clockwise).
Close the spectrometer.
Measure your sample(s).

When Finished
Put on new gloves.
Return slit to original position (Fully Clockwise).
Remove the LWNF.
Install the 532nm edge filter.
Run a health check (532nm regular).
Vendor Contacts:

Sample info:

Other Instruments:
Harvard CNS
MIT Institute for Soldier Nanotechnology
ACKNOWLEDGMENT OF SUPPORT:
CMSE requires that all publications and patents resulting from work done under this project or with the assistance of the CMSE Facilities, be acknowledged. Please be certain that one (or a combination) of the following statements is included in papers with support from CMSE:

"This work was supported primarily by the MRSEC Program of the National Science Foundation under award number DMR - 1419807."
-or-
"This work was supported in part by the MRSEC Program of the National Science Foundation under award number DMR - 1419807."
-or-
"This work made use of the Shared Experimental Facilities supported in part by the MRSEC Program of the National Science Foundation under award number DMR - 1419807."
Instrument Specifics:
https://mtim.mit.edu/asef-otc-web/instruments/raman

Renishaw Invia Reflex Raman Confocal Microscope

This is a fully automated confocal Raman microscope system with three laser excitation lines a motorized stage and open sample compartment to accommodate cryostats. A Temperature controlled microscope stage is available for temperature dependent measurements.

Raman Reflex Beampath
**Data Acquisition Modes:**
Point Mapping
Imaging - Stream HR fast imaging
Depth Profiling
Polarization
Time Dependent
Temperature Dependent
Atmosphere Dependent
Photoluminescence

**Laser Sources:**
- 473nm: 25mw Linear & Circular
- 532nm: 50mw automated rotate linear
- 785nm: 100mw Linear & Circular

**Detector:** 100cm-1 to 10,000cm-1
1” CCD array, Deep Depletion for enhanced IR Range
400-1050nm, 1024 X 256 pixel

**Gratings:**
- 600l/mm, 1200l/mm, 2400l/mm

**Rayleigh Filters:**
- 473nm edge: 10%@150cm-1 shift, for Photoluminescence measurements
- 532nm eclipse: <15cm-1 shift, Stokes & AntiStokes
- 532nm edge: ~100cm-1,
- 785nm edge: 10%@50cm-1 Rectangle w/o aperture

**Microscope:**
Leica Optical Microscope
Infinity Corrected, 200mm Tube Length
Free Space with enclosure

**Objectives:**
Semi par-focal

<table>
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<th>Objective</th>
<th>Opening</th>
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<tr>
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<tr>
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<tr>
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<td>4mm</td>
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<tr>
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<td>~3mm</td>
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<tr>
<td>100X</td>
<td>2mm</td>
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Reflected Light Polarization

**Microscope Stages:**
Renishaw HSES motorized stage  
Step Size: 100nm  
Stage Travel: 112mm x 76mm

**Rotating Microscope stage** - polarization experiments

**Temperature controlled microscope stage**
Linkam THMS600 (-196deg C to 600deg C).  
Macro Sampling Set:  
Cuvettes, Powders, Capillaries, Etc.  
Computer & Monitor  
HP Computer  
Monitor 22”  
Reference Spectra:  
Organic Polymers, Inorganic materials, Sample substrates  
Features:  
Data Analysis Software available to users.

*****End******