

Overview

The LabRAM HR UV-NIR instrument is a single stage dispersive Raman microscope system with an 800 mm high-resolution spectrograph. The Raman/laser filtering is based on edge filters in an injection/rejection configuration. The system is adapted to a PARK XE-100 AFM system.

Technical details

Lasers and optics:

- Helium-neon laser:
 - 633 nm @ 30 mW (estimated power on sample 17 mW)
- Argon laser:
 - 488 nm @ 40 mW
 - 514 nm @ 50 mW
 - possible upgrade: 457 nm @ 10 mW
- Infrared diode laser:
 - 785 nm @ 100 mW
- Laser spot diameter: < 1 μm
- Laser filter: edge filter allowing Stokes measurements above 100 cm^{-1}
- Attenuation filters: 0 dB, -3 dB, -6 dB, -10 dB, -20 dB, -30 dB, -40 dB (motorized)
- Optics spectral range: 220...1600 nm

Optical microscope:

- Model: Olympus BX41
- Stage: motorized XYZ stage with PC and joystick control
 - scan area $75 \times 50\text{ mm}$ (X \times Y)
 - step size $0.1\ \mu\text{m}$
 - allows automated acquisition of Raman maps
- Light source: top and bottom
- Objectives:
 - 10x, NA = 0.25, WD = 10.6 mm
 - 20x, NA = 0.35, long-WD (SLMPL)
 - 50x, NA = 0.75, WD = 0.37 mm
 - 100x, NA = 0.9, WD = 0.21 mm
- Optical camera: $\mu\text{Eye UI-1540SE-C-BG}$

Spectrograph:

- Focal length: 800 mm
- Gratings:
 - Visible light: 600 gr/mm and 1800 gr/mm ($76 \times 76\text{ mm}$, motorized)
 - Infrared: 1200 gr/mm ($76 \times 76\text{ mm}$, has to be changed manually)
- Spectral resolution: $0.35\text{ cm}^{-1}/\text{pixel}$ (at 633 nm with 1800 gr/mm grating)
- Motorized entrance slit used as a confocal pinhole (continuously adjustable)
- Axial confocal performance: < $2\ \mu\text{m}$ (dependent on pinhole size)

Detector:

- Type: CCD
- Resolution: 1024×256 (pixel size $26 \times 26\ \mu\text{m}$)
- Operating temperature: $-70\text{ }^\circ\text{C}$
- Spectral range: 200...1050 nm
- Quantum efficiency: > 30 % (500...800 nm)
- Typical read-out noise: $4\ e^-$ (rms)
- Dark noise: < $0.002\ e^-/(\text{pixel}\cdot\text{s})$

AFM adaptation:

- Commuting mirror for beam path selection
- Objective: 50x, long-WD (SLMPL)
- Beam angle: 30°
- Optical camera: uEye UI-1220SE-C-HQ