Lightnovo

- HIGH RESOLUTION
- FAST MAPPING
- NON-DESTRUCTIVE 3D RAMAN IMAGING
- UP TO 4 LASER SOURCES WITH AUTOMATED FAST SWITCHING
- ARTIFACTS-FREE POLARIZED RAMAN SPECTROSCOPY
- QRICO TECHNOLOGY

THOR system

Mirrorless confocal Raman microscope

TECHNOLOGY

THOR microscope perfectly suits for any kind of demanding Raman spectroscopy applications that require high spectral and spatial resolution, large mapping area, extremely stable laser power, high sensitivity and broad spectral range (from low frequency to high frequency Raman shift).

Technology is based on high throughput transmittance diffraction optics with up to 85% efficiency from sample to detector.

Up to four different lasers can be installed in the system 405nm, 532m, 633nm and 785nm. Extremely stable laser wavelength and laser power (0.1% fluctuation during 8 hours of operation).

THOR microscope equipped with motorized mechanics for switching between lasers, Raman filters, gratings, white light microscopy filters and other optical components. Microscopy system allows for both sample viewing using the optical microscopy capabilities and performing measurements by Raman spectroscopy simultaneously.

The visual observation reveals morphological details of a sample (e.g. color, size, shape), whereas the spectroscopic measurement reveals information about the molecular structure and chemical composition of a sample.

THOR can be upgraded for Quantitative Raman Imaging for Crystal Orientation (qRICO technology).

qRICO is developed in collaboration with our partner Xnovo Technology ApS https://xnovotech.com/

THOR technology covered by two international patents licensed by Lightnovo:

ACCESSORIES

- microscope objectives with magnification 10x (NA=0.25), 20x (NA=0.4), 50x (NA=0.5), 100x (NA=0.95)
- custom microscope objectives available upon request
- adaptors for different sample measurement modalities
- calibration set of samples for Raman microscopy and Polarized Raman microscopy

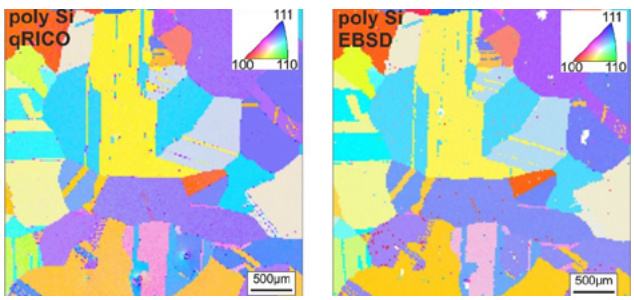


Fig. I. (A) orientation map of polycrystalline Si solar cell obtained by qRICO, (B) orientation map of polycrystalline Si solar cell obtained by electron microscope EBSD of the same area as shown on Fig. IA. The colors refer to the orientations as defined by the inverse pole figure (top right).

APPLICATIONS

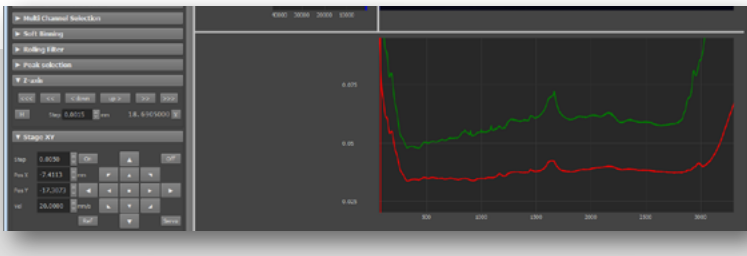
THOR ideally suited for most sophisticated Raman microscopy methods:

- fast 3D Raman imaging
- Surface Enhanced Raman Scattering (SERS) imaging
- polarized Raman imaging
- low frequency Raman measurements
- Stokes/Anti-Stokes Raman measurements
- provides fast optical shutter technology

SPECIFICATIONS

Feature versus model*	THOR B	THOR S
Spectroscopic sensor	sCMOS	EMCCD
Lasers and laser power options*	405 nm (50mW), 455nm (200mW), 532 (200mW / 500mW), 633 nm (70mW), 785nm (100mW / 500mW)	
Spectral Range	50-3700 cm^{-1}	
Spectral Resolution	3-5 cm^{-1}	
Signal-to-noise ratio**:	1000:1	
Lateral resolution***	280 nm	
Axial resolution or confocality***	600 nm	
White light microscopy	Reflected light with simultaneous visualization of laser spot and Raman spectrum acquisition	
Mapping travel range in XYZ	120 x 120 x 20 mm (0.2 x 0.2 x 0.2 mm****)	
Lateral step size	200nm (1 nm****)	
Axial step size	200nm (1 nm****)	
Physical dimensions (LxWxH)	800 mm x 800 mm x 1100 mm	
Weight	180 kg	

* ***Up to four lasers with automated switching. Custom wavelength available upon request.***
** *Determined as peak signal-to-noise ratio of polystyrene spectrum at maximal laser power, integration time 0.3s, number of repetitions 10.*
*** *Determined at microscope objective NA=0.95 at laser wavelength 532nm (magnification 100x).*
**** *With closed-loop nano stage.*



SOFTWARE

Miraspec for PC (Windows 7, 10, 11)

Software controlled by USB cable.

Data acquisition allows:

- to see white light microscopy image simultaneously with the laser spot on the sample
- to navigate over the microscopy image with XYZ sample stage manipulation
- to control motorized optomechanical units (switching of lasers, gratings, Raman filters, dichroic beam splitters, etc.)
- to set up Raman mapping parameters (mapping area, step size, exposure time, laser power, etc.)
- to measure the Raman map with required dimensions in X, Y, Z
- to set up kinetic mapping
- to perform sample surface curvature compensation during mapping (to avoid surface morphology impact on the Raman spectrum quality during mapping under high NA microscope objective)
- to carry out motorized sample rotation experiments for polarized Raman microscopy
- to carry out polarized Raman spectroscopy and Raman microscopy measurements

Data analysis allows:

- to represent Raman map at peak intensity, peak area with or without background correction
- to create Raman spectral library from the Raman map
- to decompose hyperspectral Raman map into the chemical maps using PCA, MCR and NNLS
- to pre-process polarized Raman maps*
- to reconstruct polarized Raman maps into crystallographic orientation maps*

* *Patented feature*

Harness the power of Raman spectroscopy and make it widely accessible for the benefit of mankind.

- Lightnovo's mission

Lightnovo has been founded in 2019 by a team united by the belief in making a difference with innovative Raman spectroscopy solutions.

Our goal is to provide premium performance Raman spectrometers and microscopes with the world's smallest form factor at a price that democratizes access and opens new application areas.

It is our vision to become the recognized leader in providing the highest value Raman spectroscopy and Raman microscopy solutions for research, industry and healthcare.

Lightnovo

Lightnovo ApS
Blokken 15, 1. tv.
3460 Birkerød
Denmark (DK)
CVR: 40979603

+45 71 37 04 10
info@lightnovo.com
www.lightnovo.com