HORIBA Core Technology

HORIBA allocates its development resources by focusing on specific analytical and measurement technologies, through the applied development of these technologies, efficiently conducts product development in 5 business segments with different markets.

Gas Flow Control

Technology to measure and instantly control the flow of gases

EXFM-ONE
Ultrasonic Exhaust Flow Meter

MICROPOLE System
Residual Gas Analyzer

ENDA series
Stack Gas Analyzer

Infrared Measurement

Technology for real-time analysis of elements in gases

PG-300 series
Portable Gas Analyzer

MEXA-ONE series
Motor Exhaust Gas Analyzer

EMIA series
Carbon/Sulfur Analyzer

Spectroscopic Analysis

Technology to measure a wavelength and an intensity of the incident electromagnetic wave on substances

Yumizen H630 CRP
Hematology & CRP Analyzer

LabRAM HR Evolution
Laser Raman Spectroscope

CS-700
Chemical Solution Concentration Monitor

Particle-size Distribution Analysis

Technology to measure particle diameter and size distribution

Partica LA-960 Series
Laser Scattering Particle Size Distribution Analyzer

RP-1
Reticle/Mask Particle Remover

Electrochemistry

Technology to measure potential and/or electric current accompanied with interfacial chemical reaction

H-1 series
Industrial Water Quality Analyzer

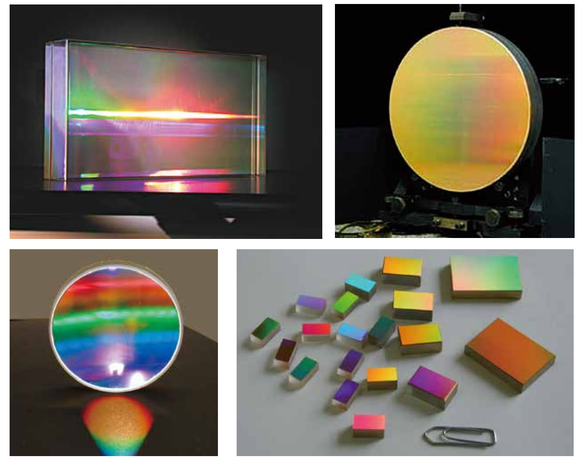
HF-960EM
Hydrofluoric Acid Sensor

Antsense series
Electrode Type Blood Glucose Meter

LAQUA series
Benchtop pH/Water Quality Analyzer

HORIBA Jobin Yvon's world-leading spectroscopy technology

A key component of spectrometers is the grating, which diffracts incident rays into various wavelengths.
Jobin Yvon has been a pioneer in the grating field about for 200 years, and joined HORIBA Group in 1997. The combination of HORIBA and Jobin Yvon's advanced technology bases has led to cutting-edge new devices.



Why HORIBA Jobin Yvon is a pioneer in the spectroscopy field

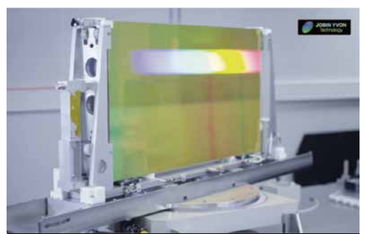
HORIBA Jobin Yvon's advanced optical designs provide a foundation for technical innovations containing a variety of gratings. We carry out all processes in-house, from the design and production of gratings to production of spectrometers containing those gratings.

Our technology recognized by NASA*

In 2006, HORIBA Jobin Yvon won a NASA JPL (Jet Propulsion Laboratory) Award for three outstanding varieties of OCO gratings*.

(OCO gratings are superior due to their high precision, high diffraction efficiency and low scattering, enabling measurement of very weak spectrum under extreme conditions.)

2012
HORIBA Europe Research Center was established in Saclay, a suburb of Paris, France. This center focuses on building a cooperative framework with industrial, academic, governmental and educational institutions.



2016
A meters-large holographic grating was developed and produced at HORIBA Europe Research Center.

2016
NASA's JUNO probe entered Jupiter's orbit. The probe contains HORIBA gratings.

Three main bases in Japan, Europe and North America

HORIBA Scientific has three main research, development and production bases, each a leading vendor for a different type of optical analysis technology.

HORIBA Jobin Yvon

Core **Optical devices and emission spectrometry**

Main Product

- Raman microscopes
- GD-OES
- Spectroscopic ellipsometers
- ICP-OES
- Optical components

HORIBA, Ltd.

Core **X-ray, infrared, particle size, gas and water quality analysis**

Main Product

- Particle size distribution analyzers
- X-Ray analytical microscopes
- C/S/O/N/H analyzers
- pH/water quality analyzers

HORIBA Instruments Inc.

Core **Fluorescence spectroscopy measurement**

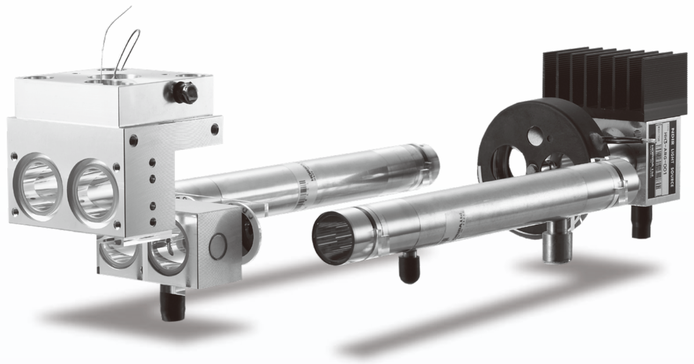
Main Product

- Fluorescence steady state spectrometers and fluorescence lifetime spectrometers
- Intracellular imaging
- Spectrometers

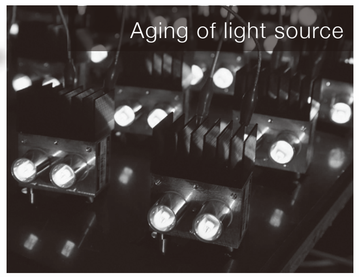
Mutual development and jointly developed products

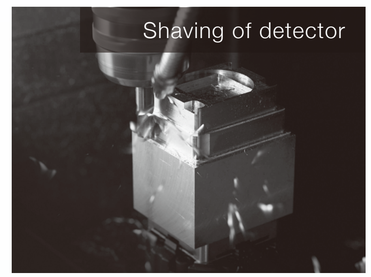
HORIBA’s manufacturing with long-term stability and reliability

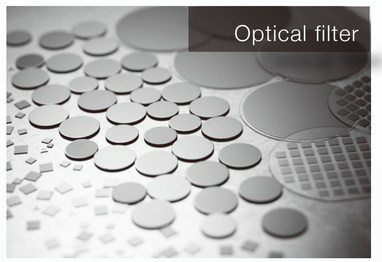
To create highly reliable analyzers, HORIBA takes the utmost care with every step of the process, from material production to assembly and aging. When producing the sensor section at the core of the device, every step from the polishing and quality check of the parts to assembly is carried out in-house to build a solid foundation of quality.

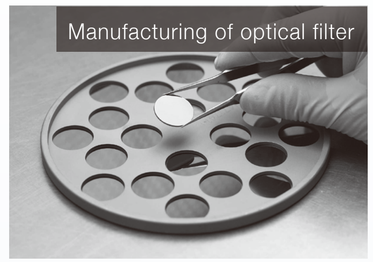


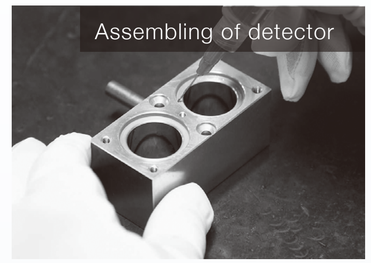
Main parts of a Non-Dispersive Infrared (NDIR) analyzer used to measure CO and CO_2











The flagship factory HORIBA BIWAKO E-HARBOR (Japan)

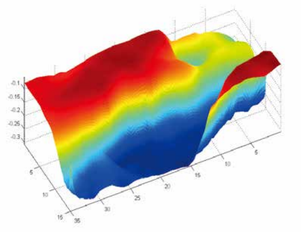
E =
Engineering
Enhancement
Engagement
Environment
Energy System

Building area: 7,125 m^2
Total floor area: 28,177 m^2
Number of employees (as of 2016): About 600
(incl. part-time employees and affiliate companies)

Raman Spectroscopy Application Categories

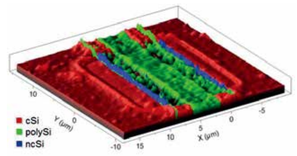
Carbon Materials

- Carbon nanotube
  - Diameter, chirality, doping, etc.
- Graphene
  - Layers, defects, etc.
- Others
  - sp^2 and sp^3 structure
  - DLC coating properties
  - Diamond quality and provenance



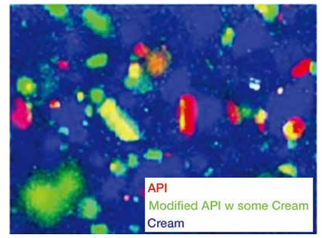
Semiconductors

- Stress/strain analysis
- Doping/Defect
- Contaminations
- Superlattice structure
- Crystal form analysis
- Photoluminescence (PL)
- Micro-analysis



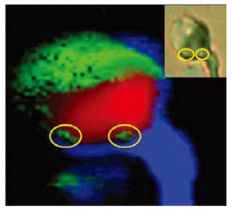
Pharmaceuticals - Cosmetics

- Chemical identification content uniformity
- API quantification
- High-throughput screening
- Polymorphs, crystal-form transformation and thermal stability analysis
- Drug counterfeiting and additive detection
- Drug-cell interaction
- Real-time reaction monitoring and terminal product detection



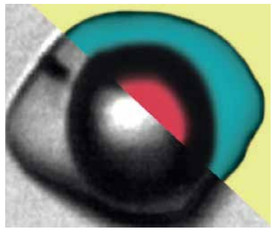
Life Sciences

- Bio-macromolecule (lipids, proteins, carbohydrates, DNA, etc.)
- Bacteria location, identification and classification
- Cell analysis (cell imaging)
- Drug distribution in cells/tissues
- Diseases & early diagnosis, oncology
- Label-free in-vivo and in-vitro analysis
- Nanotoxicology



Geology

- Minerals/crystal forms
- Fluid inclusion
- Phase transformation
- In-situ high/low temperature reaction
- Thermal oxidation of organic materials
- Fluorescence micro-analysis

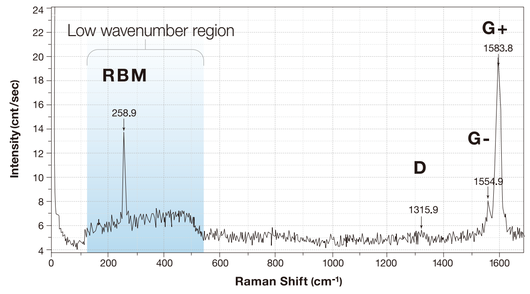


Jewelry - Museum - Forensics

- Gemstones/jade
- Metalware corrosion
- Cellulose/Textiles/Fibers
- Handwriting authentication
- Explosives/bullet remnants
- Printing inks/pigments
- Drugs

Carbon Materials

Measuring diameter of CNT



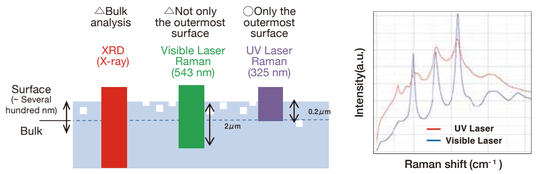
Raman Spectrum of SWCNT (Single Wall Carbon Nano Tube)

CNT diameter can be evaluated by analyzing RBM.
The RBM is a mode in which SWCNT stretches in the diametrical direction.
It has correlation with the diameter of SWCNT at the peak between 100 - 300 cm^{-1}.

LabRAM HR Evolution

Semiconductors

Crystalline evaluation of outermost surface of semiconductor material



Comparison of penetration length of X-ray and laser

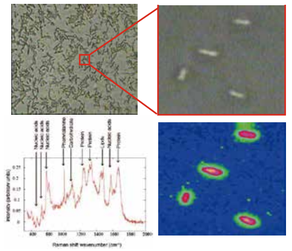
Visible and ultraviolet laser Raman spectra measured at the same location

The differences in crystalline can be detected by using ultraviolet laser microscope Raman spectroscopy for the difference in crystalline of the sample's outermost surface, which could not be conventionally distinguished by XRD or visible laser microscopy Raman spectroscopy.

XploRA PLUS

Life Sciences

Bacteria identification



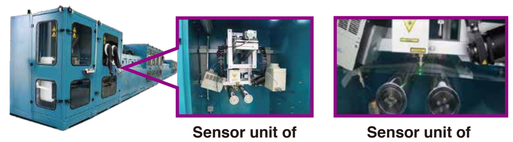
- Raman imaging gives a distribution and chemical information.
- Raman data analyzed by multivariate analysis shows us a good discrimination of the bacteria species.

The bacteria species could be identified by the combination of Raman and multivariate analysis .

XploRA INV

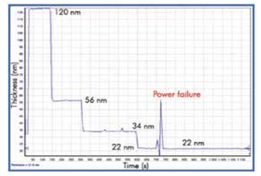
Films

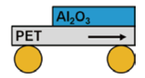
In-line analysis of film thickness and composition in Roll to Roll production process



Sensor unit of Raman

Sensor unit of Ellipsometer





Al_2O_3 film on PET Substrate

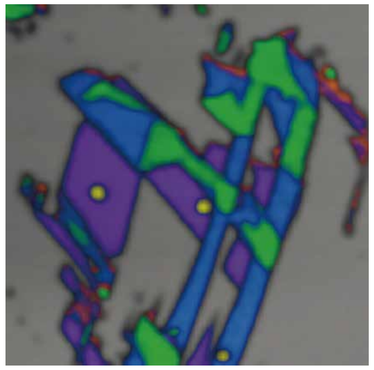
In the Roll to Roll film production process, the film is pulled at the other side during coating and wounded on the opposite side. At this time, the variation in coating film thickness and composition change affects the yield.
By installing sensors of Raman and ellipsometer in the Roll to Roll production equipment, the variation in coating film thickness and composition change can be monitored in line, during the production process.

AFM-Raman

HORIBA Scientific and AIST-NT, manufacturer of advanced SPM systems designed specifically for integration with optical spectroscopy, provide an innovative solution that addresses the challenges of NanoRaman imaging.

Co-localized Raman-AFM

Conventional Micro-Raman provides diffraction limited sub-micron spatial resolution. Co-localized measurement is all about overlapping a Raman map with an AFM map (topography, phase, capacitance, etc.).

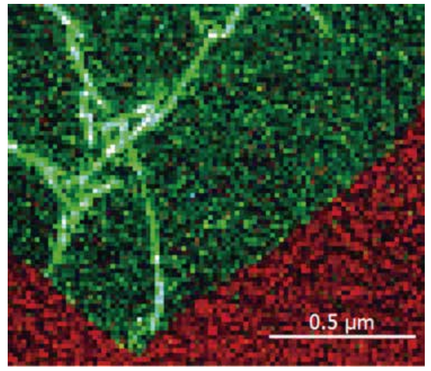


Composite Raman image of a graphene flake

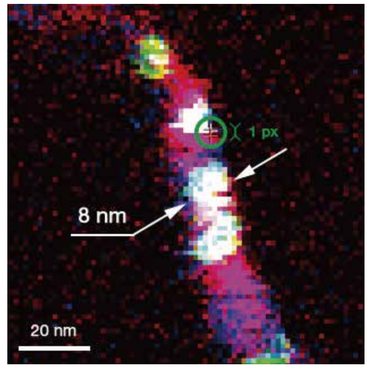
AFM Capacitance image of the same graphene flake

TERS: Tip Enhanced Raman Spectroscopy

TERS brings you the chemical specificity of Raman spectroscopy with imaging at spatial resolution typically down to 10 nm.
This technique can be demonstrated on various samples ranging from 1D, 2D nanomaterials, organic molecules and polymers, to life sciences samples.

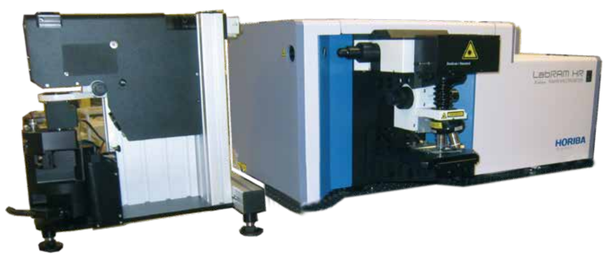


D-band TERS map of a graphene oxide flake



TERS mapping of a single carbon nanotube showing an optical spatial resolution down to 8 nm confirmed from the section analysis of the intensity of the TERS bands.

XploRA Nano



LabRAM HR Evolution Nano

LabRAM HR Evolution and XploRA PLUS/INV integrated with Scanning Probe Microscopes (SPM) can provide nano imaging spectroscopy of Raman and SPM simultaneously. Compact, fully automated and easy-to-use Nano Raman systems for high speed TERS imaging at nano scale.

CombiScope XploRA

CombiScope XploRA is a fully integrated compact AFM-Raman system dedicated to transparent samples (Life sciences).

For Details of HORIBA Raman Lineup: www.horiba.com/scientific/products/raman-spectroscopy/

Raman Microscope

XploRA PLUS

For research and analytical labs

XploRA series Raman Microscope

Fully automated and fully confocal Raman microscopes allow fast non-destructive chemical micro-analysis and Raman chemical imaging.

XploRA INV

For biological applications

XploRA One

For industrial and routine analysis

[Excitation] 532 or 785 nm (XploRA One)
532, 638, 785 nm, others on request (XploRA PLUS/INV)

[Confocal imaging]
1 µm XY (XploRA One), 0.5 µm XY (XploRA PLUS/INV)

LabRAM HR Evolution

Ultimate Raman Spectroscopy

High spectral and spatial resolution analytical Raman microscope ideally suited to both micro and macro measurements, with advanced confocal imaging capabilities in 2D and 3D.

[Spectral range] UV-NIR (200 - 2,100 nm)
[Cutoff] >50 cm^{-1} (Standard), >5 cm^{-1} (Option)
[Detectors] Up to three detectors

Modular and Fiber Coupled Raman

A range of spectrometers and detectors for integrating into your own Raman experiment, with performance to suit all requirements.

Modular Raman

Transmission Raman

Provides a cost effective access to a technique ideally suited to bulk chemical analysis of opaque samples, including powders and tablets.

Transmission Raman

Macro Raman

Benchtop and portable Raman systems designed for portability and high quality Raman measurements:

MacroRAM

Affordable Benchtop Raman Spectrometer

Triple Raman

The Triple grating Raman spectrometer offers the ultimate in spectroscopic performance.
For fundamental research and advanced application of chemical analysis using Raman spectroscopy.

T64000

Triple Raman System

SEM Raman

Versatile with possibility to measure Raman, Photoluminescence and Cathodoluminescence.
For identification of compounds molecular bindings, phases and polymorphism of its sample under vacuum, eventually at low temperature using a cold sample stage.

R-CLUE

SEM-Raman

Process Raman

High efficiency dedicated process Raman analyzer for rugged and robust Raman monitoring.

Process Raman