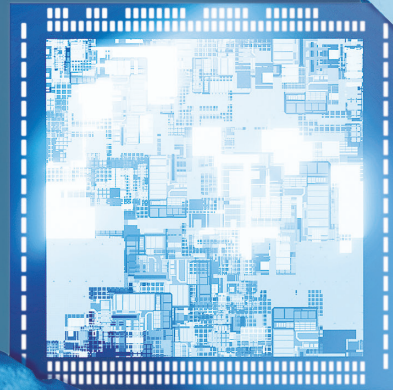


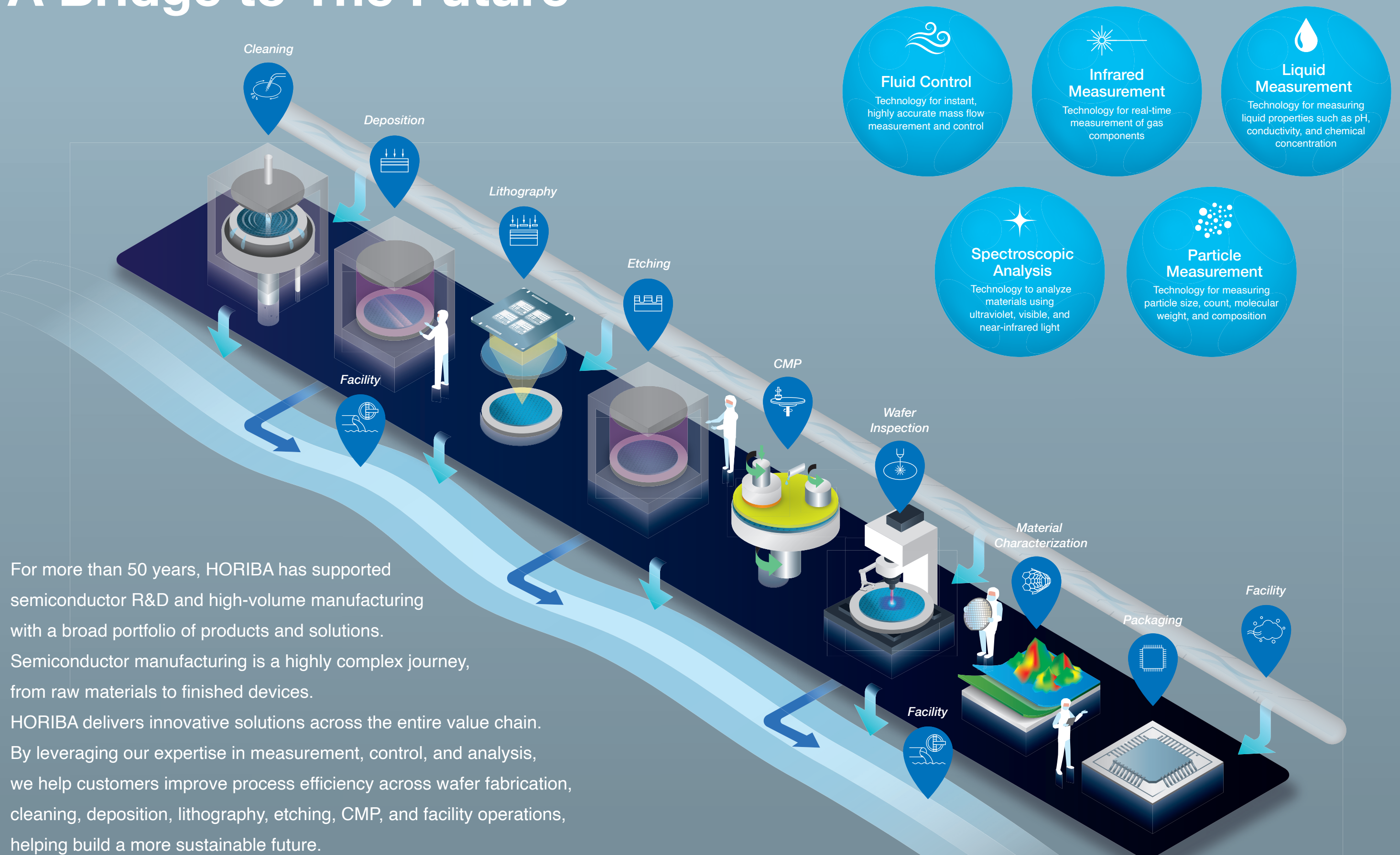
HORIBA

ADVANCED SOLUTIONS FOR THE SEMICONDUCTOR INDUSTRY

Cutting-edge technologies and
comprehensive solutions supporting
the future of ever-evolving
semiconductor manufacturing



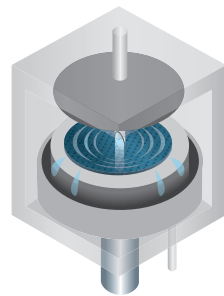
HORIBA's Measuring Technologies, A Bridge to The Future



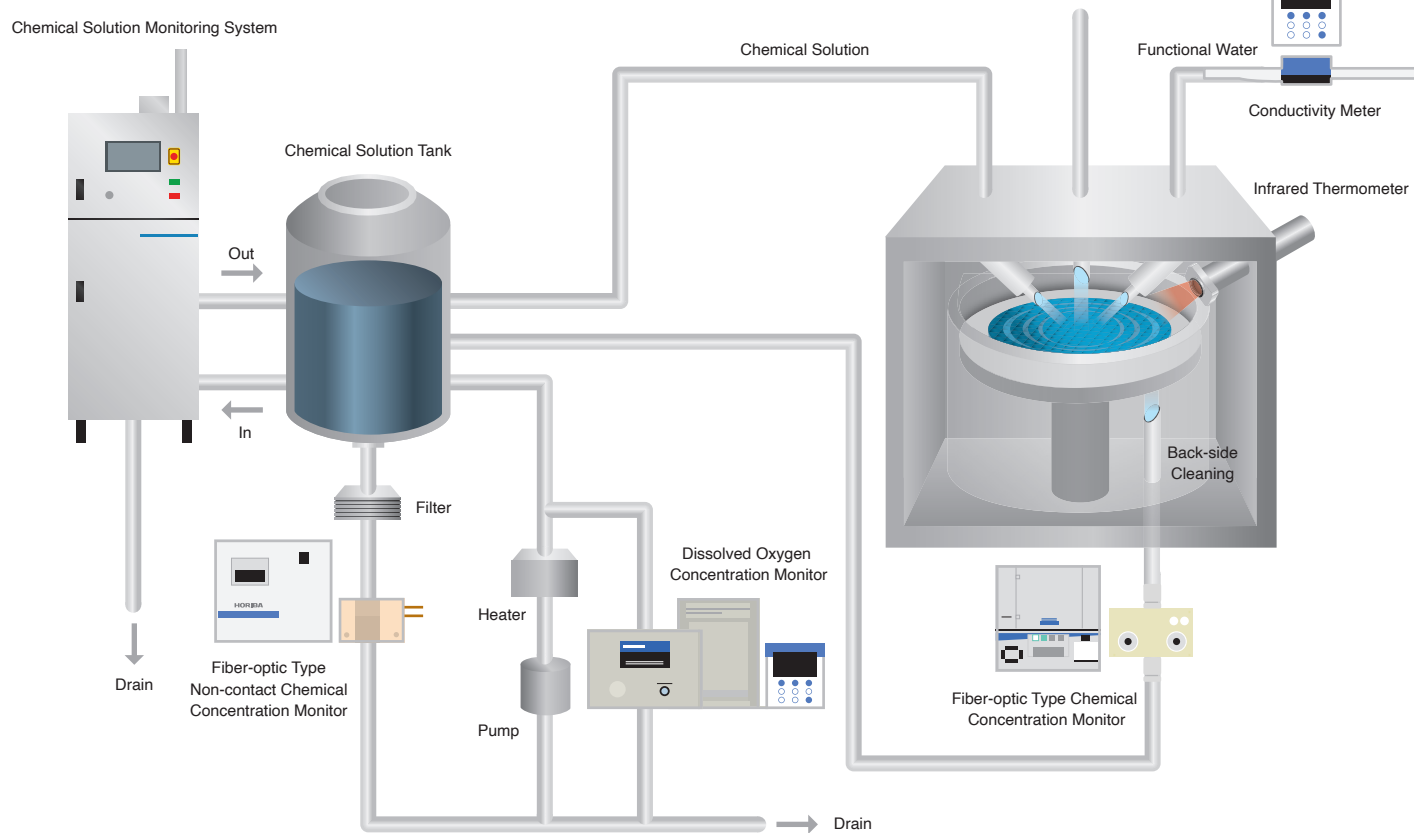


Cleaning

In critical cleaning processes following key semiconductor manufacturing steps such as CMP and etching, it is essential to remove chemical residues and particulate contaminants without damaging or altering the wafer surface. To optimize these cleaning processes, HORIBA offers a wide range of products that accurately monitor chemical concentrations in cleaning solutions.



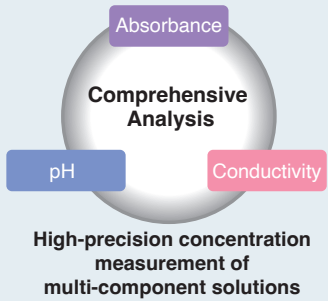
Chemical Solution Monitoring System



	Mass Flow Controller	Infrared Thermometer	Micro Volume pH Monitor	Fiber-optic Type Chemical Concentration Monitor	(Hot Phosphoric Acid)	(Non-contact Type)	Chemical Solution Monitoring System	HF Concentration Monitor	Dissolved Oxygen Concentration Monitor	Conductivity Meter
Fluid Control	○									
HF Etching Solution				○						
Liquid Surface Temperature		○						○	○	
Nitride Etching Solution				○	○					
Photoresist Stripping				○		○				
Functional Water									○	○
Bulk Chemical Cleaning				○	○	○		○	○	
Specialty Chemical Cleaning			○				○			

High-precision Monitoring of Specialty Chemicals

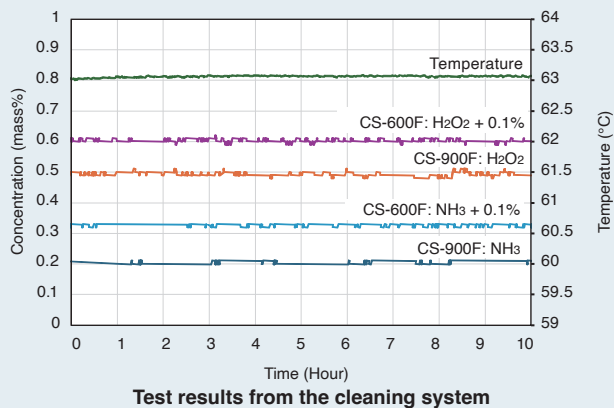
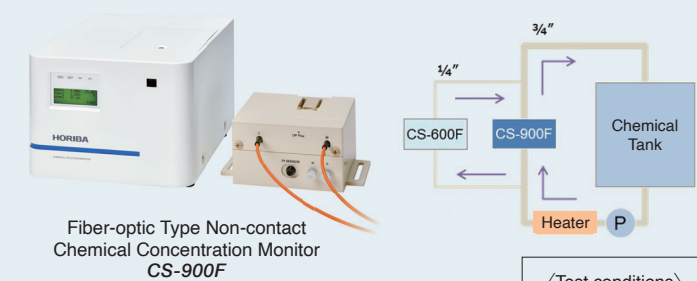
As semiconductor processes continue to scale down, more precise control of wafer surface conditions is required. The CS-1000 standalone Chemical Solution Monitoring System uses proprietary analytical technology combining absorbance, pH, and conductivity to accurately detect trace components in specialty chemicals.



Chemical Solution Monitoring System CS-1000

Stable “Non-contact” Measurement of Chemical Concentration

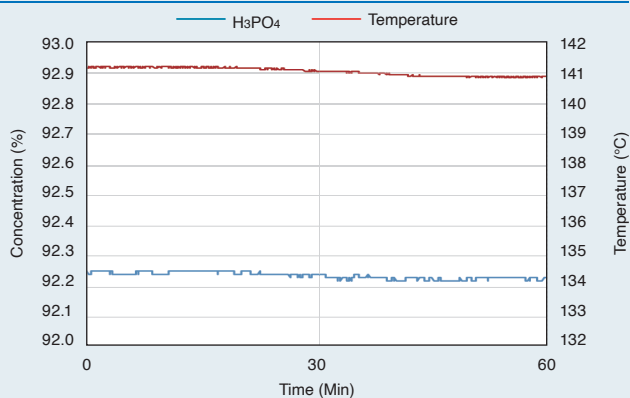
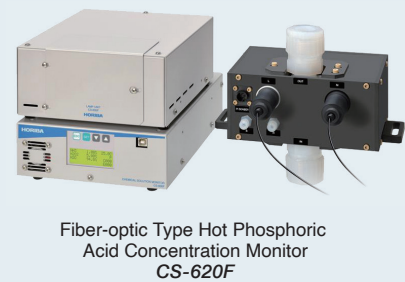
The CS-900F Fiber-optic Type Non-contact Chemical Concentration Monitor helps prevent leakage and contamination, improving safety and reducing chemical use. Tests on cleaning equipment confirmed equivalent performance to the conventional contact-type model (CS-600F), even in piping-mounted non-contact measurements.



〈Test conditions〉 Ammonia concentration : 0.2% Hydrogen peroxide concentration : 0.5% Tank temperature : 65°C

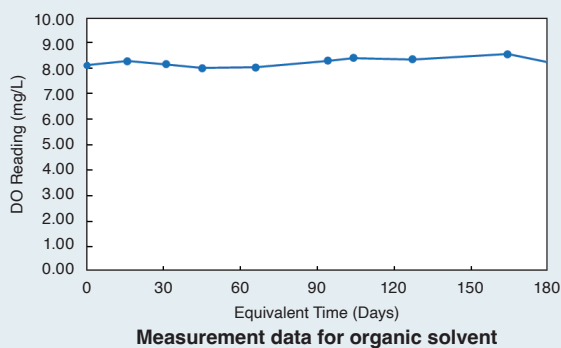
Hot Phosphoric Acid Monitoring During the Etching Process

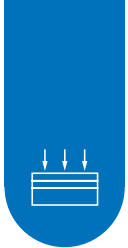
The CS-620F Fiber-optic Type Hot Phosphoric Acid Concentration Monitor measures high-temperature, high-concentration phosphoric acid in real time without cooling. It is ideal for concentration control in the SiN etching process for 3D NAND manufacturing.



Dissolved Oxygen Concentration Monitoring in Chemical Solutions

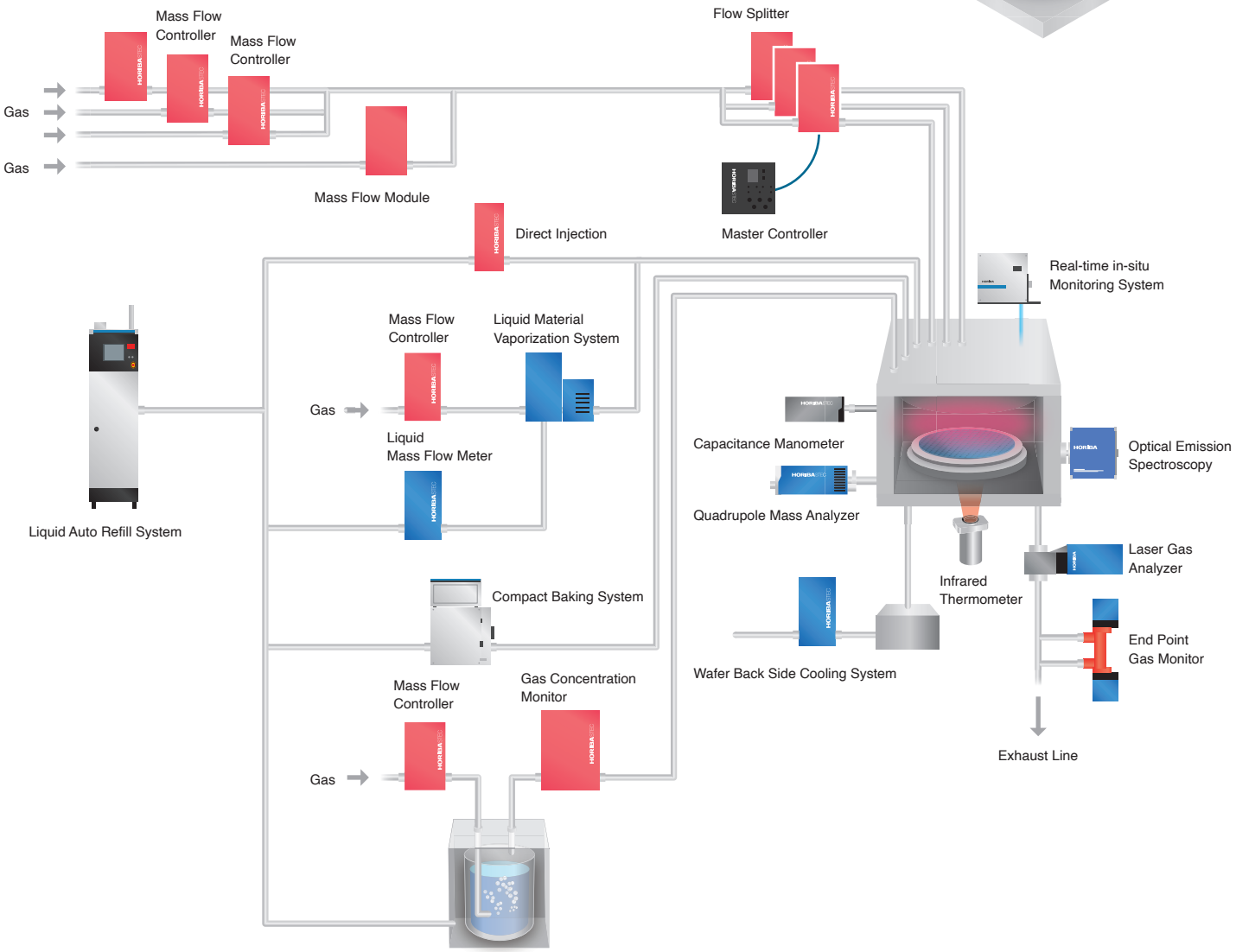
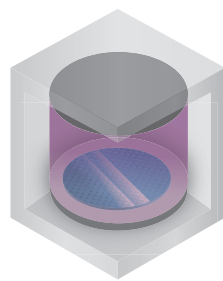
Monitoring dissolved oxygen in dilute HF and TMAH solutions used in semiconductor cleaning processes is critical, as it directly affects yield. The HD-960LR Dissolved Oxygen Monitor is also compatible with high-boiling-point organic solvents such as ethylene glycol, as well as volatile chemicals such as ammonia water.





Deposition

Deposition is a critical process in the semiconductor industry. HORIBA offers a wide range of products to optimize this process and improve yield.



Chamber Cleaning Endpoint

- Optical Emission Spectroscopy
- End Point Gas Monitor

Chamber Health Monitoring

- Optical Emission Spectroscopy
- Capacitance Manometer
- Quadrupole Mass Analyzer
- Laser Gas Analyzer
- Gas Monitor for End Point Detection
- Infrared Thermometer

Film Thickness Monitoring

- Spectroscopic Ellipsometer

Measurement of Film Thickness/ Temperature/ Curvature

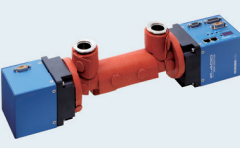
- Real-time in-situ Monitoring System

Gas Delivery

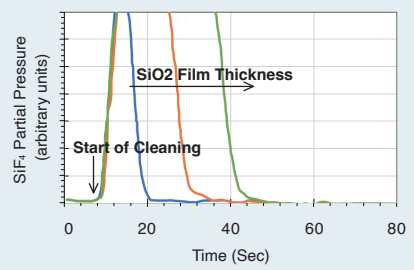
- Mass Flow Module
- Mass Flow Controller
- Vapor Concentration Monitor
- Flow Splitter
- Mixed Injection System Liquid Vaporizer
- Liquid Auto Refill System

Chamber Cleaning Endpoint

With advances in microfabrication, keeping chambers clean after processing has become essential to improving productivity in semiconductor deposition processes. The IR-400 Series Chamber Cleaning Endpoint Gas Monitor measures exhaust gas components such as SiF₄ and CF₄ in real time, helping optimize dry-cleaning endpoint detection, reduce cleaning gas consumption and cycle time, and extend part life.

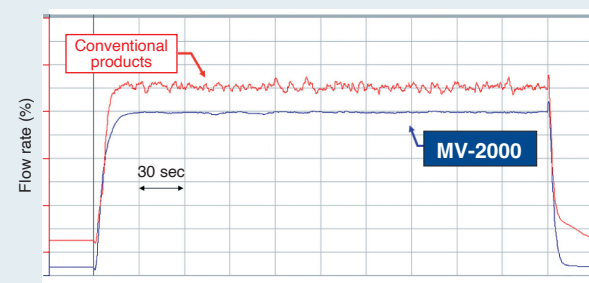


Chamber Cleaning End Point Gas Monitor IR-400 Series

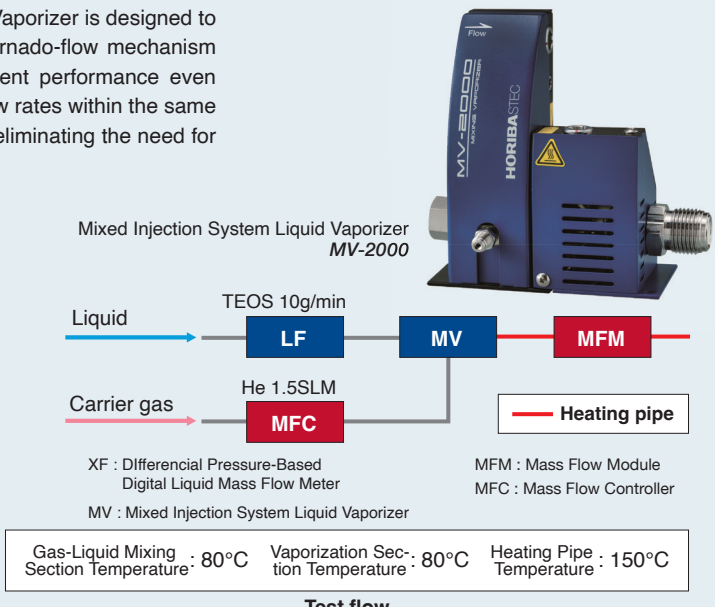


Stable, High-flow Vaporization Using the Tornado Flow Method

The MV-2000 high-performance Mixed Injection System Liquid Vaporizer is designed to vaporize pure water and liquid chemicals. Its high-efficiency tornado-flow mechanism enables stable low-temperature vaporization, delivering excellent performance even with thermally sensitive liquids. In addition, it supports higher flow rates within the same footprint and operating temperature range as previous models, eliminating the need for layout changes.



Stability Data (Comparison by Flow Rate)

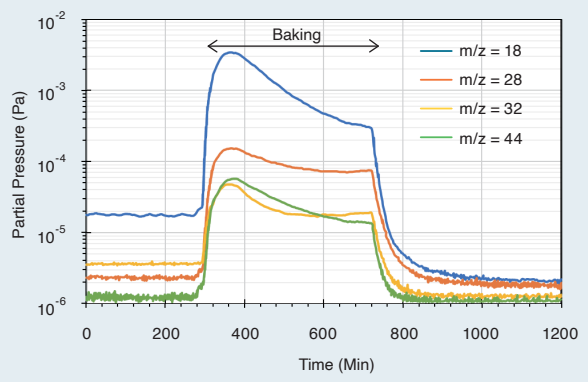


Chamber Health Monitoring

The Micropole System QL Series Quadrupole Mass Analyzer monitors residual H₂O adsorbed on chamber walls as well as H₂O desorbed during the baking process. By monitoring residual and process gases in the process chamber and measuring base pressure, it is ideal for controlling vacuum chamber conditions and monitoring processes.



Quadrupole Mass Analyzer Micropole System QL Series



Typical trends of m/z peaks in a series of mass spectra obtained during vacuum pumping

Capable of Continuous Feeding for Extended Periods

By applying our proprietary concepts and advanced technologies to each vaporization method — bubbling, baking, and direct vaporization — we deliver high-performance vaporization systems that meet increasingly demanding customer requirements.

Stable Liquid Supply for Continuous Operation

Long-term continuous operation requires a stable liquid supply. The LU Series Liquid Auto Refill System ensures stable operation by precisely controlling pressure and temperature. For baking systems, it stabilizes liquid temperature to prevent fluctuations in the vaporization tank; for direct vaporization systems, it maintains optimal pressure during refilling.

Safe Source Tank Replacement

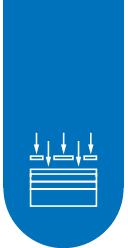
When handling toxic or flammable materials, safe tank replacement is critical. The LU Series includes a standard safety function that purges residual material from the piping and verifies that no material remains.

Uninterrupted Supply During Tank Replacement

A built-in sub-tank enables continuous liquid supply even during source tank replacement.

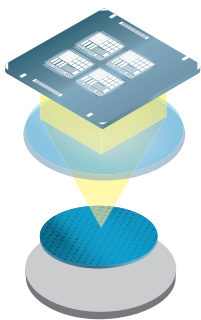


Liquid Auto Refill System LU Series



Lithography

Lithography process involves transferring the circuit patterns from a photomask onto a wafer using extreme ultraviolet (EUV) or deep ultraviolet (DUV) light. If there are contaminants on the photomask, this can lead to defects in the transferred circuit pattern, significantly impacting yield. From the photomask manufacturing process to semiconductor lithography, HORIBA provides products that help improve yield through particle control and the evaluation of pellicles and photoresists properties.



								
Mask Particle Detection	○							
Mask Particle Removal		○						
Mask Etching			○	○				
Mask Cleaning								○
Particle Analysis						○	○	
Pellicle Health Monitoring					○	○		
Photoresist Properties					○	○		

Particle Detection and Removal (Mask Blanks/ DUV Pellicles/ EUV Pellicles)

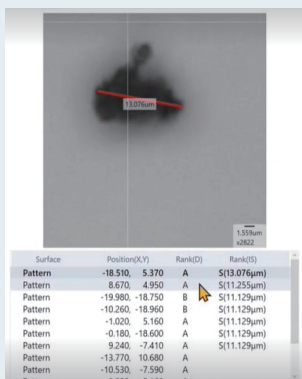
The PD Xpation (PD10) Reticle/ Mask Particle Detection System uses laser scattering technology and image processing to inspect reticles and masks for particles. Equipped with auto-focus and image capture functions, it is easy to operate and supports process control in semiconductor manufacturing lines and photomask fabrication facilities. Additionally, the PD Xpation (PD10-EX), based on the PD10, incorporates a particle removal function, enabling a complete process from detection to removal with a single unit. Furthermore, HORIBA has developed an in-house automated transport systems for reticles and masks, helping to the streamlining of semiconductor manufacturing processes and improved yield.



Reticle/ Mask Particle Detection System
PD Xpation (PD10)



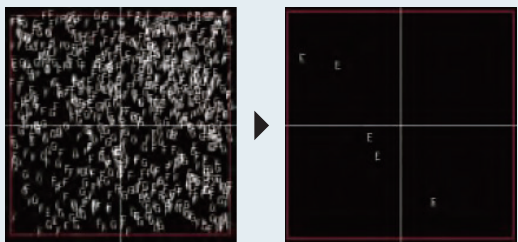
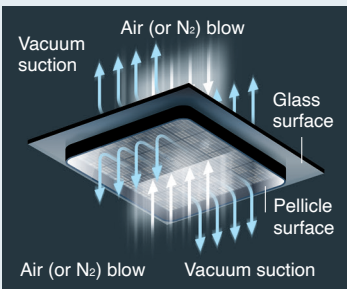
Reticle/ Mask Particle Detection System
PD Xpation (PD10-EX)



Examples of Measurement Data

Particle Removal

The RP-1 Reticle/Mask Particle Remover removes contaminants from reticle and mask surfaces. Using specialized probes positioned above and below the sample, it simultaneously dislodges contaminants and captures them by vacuum suction, preventing them from dispersing and re-adhering. Routine particle removal helps keep production lines clean and contributes to lower operating costs by extending the interval between mask cleaning cycles. When combined with the PD10, particle removal and particle inspection can be performed in a single sequence (PD10-EX).



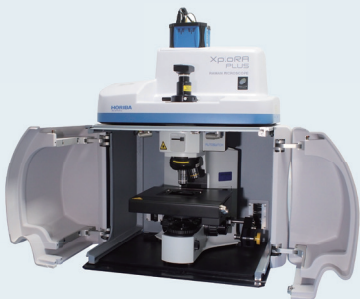
Removal of particles from a glass surface (PSL 5.0 μm)



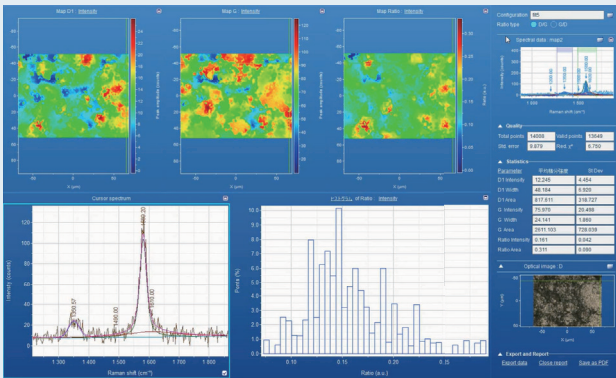
Reticle/ Mask Particle Remover
RP-1

Characterization of EUV Pellicle

Raman spectroscopy is well-suited for characterizing carbon nanotube (CNT) pellicles under consideration for use in EUV processes. The XploRA PLUS Raman Microscope can evaluate and analyze CNT pellicle wear and lifetime, supporting process and quality control.



MicroRaman Spectrometer
XploRA PLUS

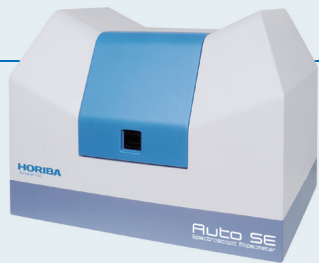


Software for automatic determination of the G/D* ratio of CNT

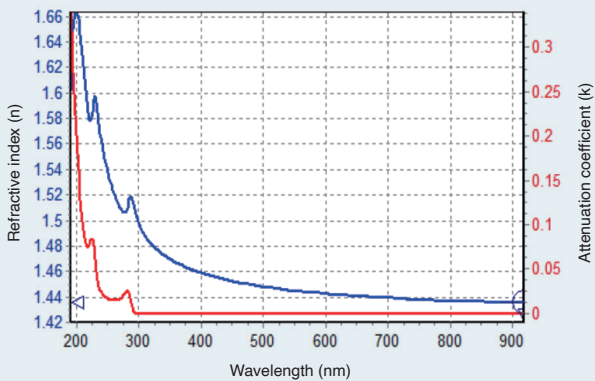
G/D ratio: A metric for evaluating crystal defects in CNTs

Characterization of Photoresists

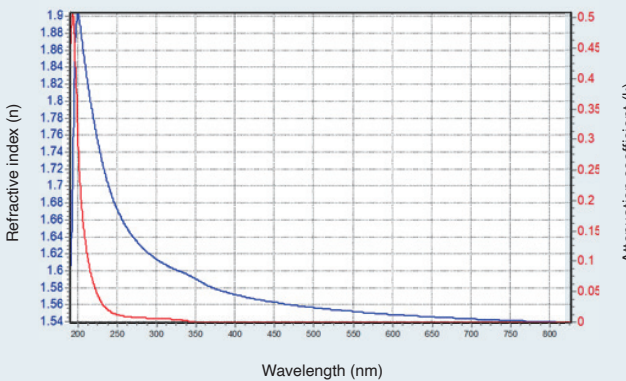
Quality control for the various photoresists used in the lithography process relies heavily on characterization of their optical properties and the control of film thickness after coating. The Auto SE Spectroscopic Ellipsometer for Simple Thin Film Measurement uses spectroscopic ellipsometry to measure and map the optical properties and film thickness of photoresists on wafers at the micro-scale, supporting quality control from material development to semiconductor production lines.



Spectroscopic Ellipsometer for Simple Thin Film Measurement
Auto SE



Optical properties of photoresists in the solvent state

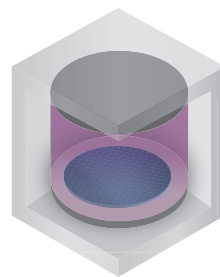
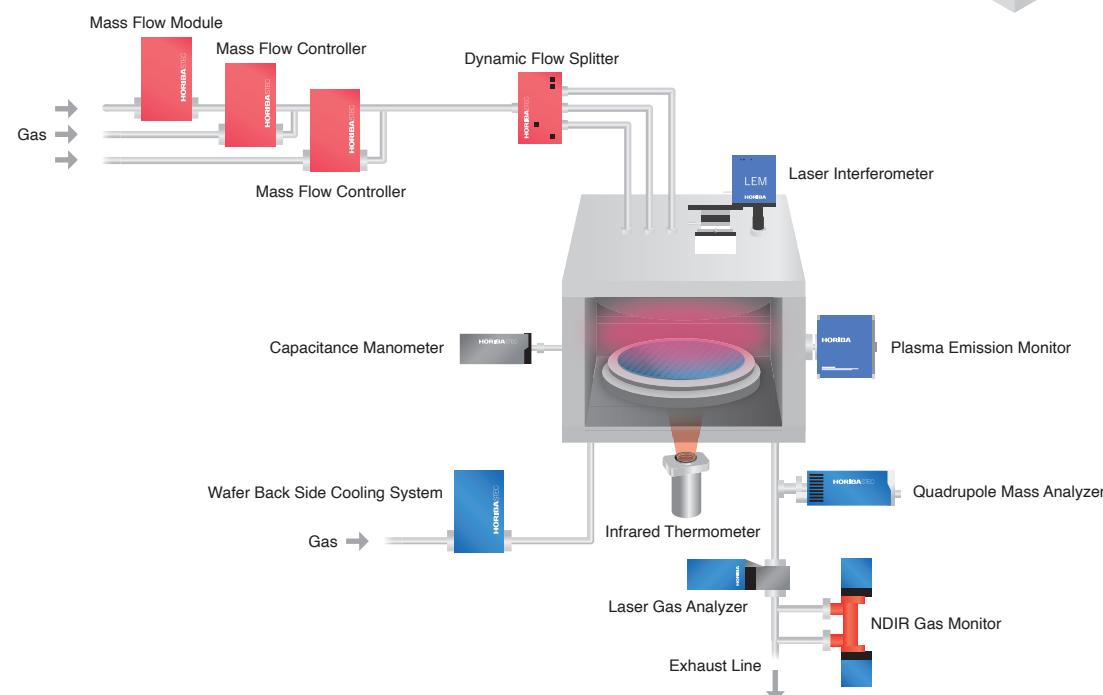


Optical properties of photoresist as a thin film on a substrate



Etching

A variety of fluid-control modules and smart sensors for endpoint detection and plasma monitoring are available to reduce chamber-to-chamber variation and optimize yield in etching tools. These compact, robust systems are suitable for both R&D and mass-production fabs.



Endpoint Detection in Chamber Cleaning

Plasma Emission Monitor
NDIR Gas Monitor

Chamber Status Monitoring

Plasma Emission Monitor
Quadrupole Mass Analyzer
Capacitance Manometer
Infrared Thermometer

Endpoint Detection

Plasma Emission Monitor
Laser Gas Analyzer
NDIR Gas Monitor
Laser Interferometer

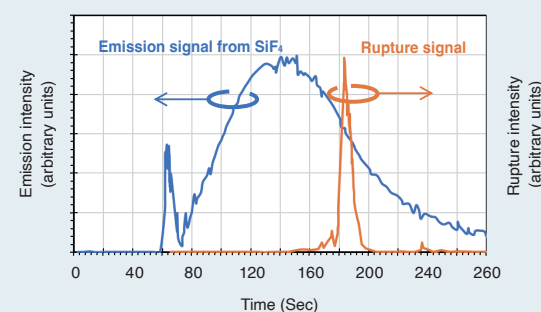
Fluid Control

Mass Flow Module
Mass Flow Controller
Flow Splitter

Endpoint Detection Using a Plasma Emission Monitor

Real-time endpoint detection in plasma etching is essential for improving yield. The Plasma Emission Monitor EV 2.0 can reliably detect endpoints even on low open-area wafers by combining a high-performance spectrometer with a robust endpoint algorithm.

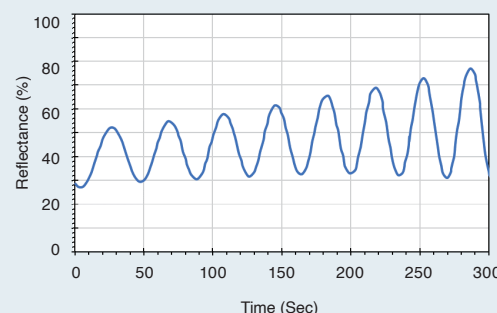
Plasma Emission Monitor
EV 2.0



Real-time Etch-depth Measurement

The LEM Series Laser Interferometer is suitable for monitoring trench depth, from shallow to deep trenches. By selecting the appropriate wavelength, it can be used in a wide range of applications, including the processing of optoelectronic devices such as laser diodes, where etch depth directly affects device characteristics.

Laser Interferometer
LEM Series



Etching Endpoint Detection

The LG-100 Series Laser Gas Analyzer measures changes in the partial pressure of SiF₄ generated during semiconductor etching in real time. Based on these changes, it determines whether the etch has reached the endpoint. Leveraging HORIBA's proprietary IRLAM infrared gas analysis technology, it directly measures trace gases with a response time of less than 0.1 seconds, helping reduce under-etching and over-etching and improve productivity and yield.

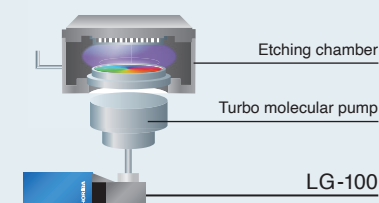
*Infrared laser absorption modulation method (IRLAM™: Infrared Laser Absorption Modulation)

*IRLAM is a registered trademark or trademark of HORIBA, Ltd.

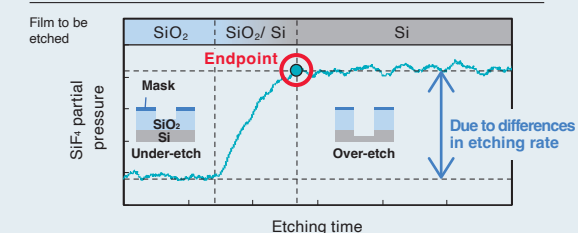
Laser Gas Analyzer
LG-100



Process monitoring in an etching chamber



Change in SiF₄ Partial Pressure



Mass Flow Controller Applications

Mass flow controllers (MFCs) measure and control fluid mass flow and are widely used in semiconductor processes and other applications that require highly precise flow measurement and control. As the latest addition to the CRITERION™ Series, HORIBA developed the Digital Mass Flow Module D700 to further enhance customer satisfaction through advanced fluid measurement and control.

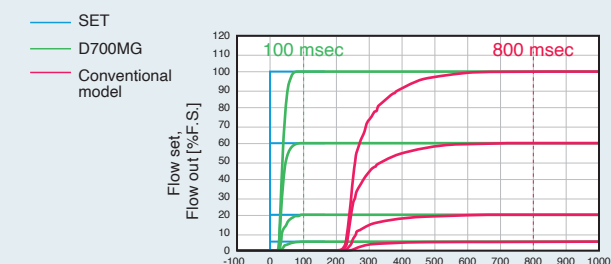
Digital Mass Flow Module
D700



High-Speed Response Within 0.1 Seconds

High-Speed Response, High-Precision Mass Flow Module D700MG

Shortening gas exchange time in the chamber is a critical issue in high-speed, continuous processes. The High-speed Response, High-precision Mass Flow Module D700MG uses a high-speed valve drive circuit and a newly developed control algorithm to achieve industry-leading startup control within 0.1 seconds. This shortens gas exchange time in the chamber and helps improve productivity and equipment operating efficiency.

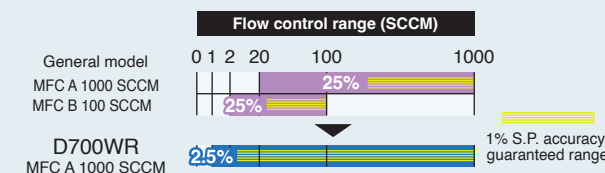


High-speed startup control within 0.1 seconds

1:1000 Wide-Range, Pressure-Insensitive

Wide-Range Mass Flow Module D700WR

Conventional systems required separate MFCs for high-flow and low-flow control in gas lines using the same gas type. The Wide-range Mass Flow Module D700WR provides a broad control range from 0.1% of full-scale flow, making it possible to replace two MFCs with one. By reducing the number of MFCs and improving gas-line efficiency, it helps deliver better performance and lower costs in applications using multiple gas types.

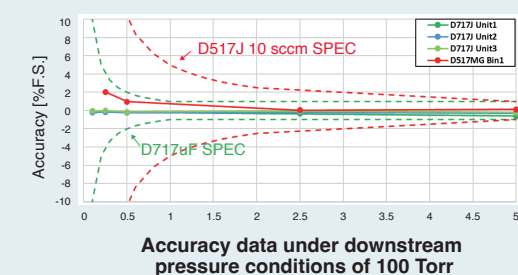


By optimally designing the laminar flow resistor (restrictor), a wider flow control range and guaranteed accuracy range have been achieved.

Improving Accuracy at Low Flow Rates

Micro Mass Flow Module D700uF

In etching processes for advanced devices, even very small changes in process gas flow rates of 5 SCCM or less can significantly affect yield. The D700uF Micro Mass Flow Module delivers precise control down to an industry-leading minimum of 0.025 SCCM. With dedicated components and a newly developed flow reference unit, it enables highly accurate measurement and control of critical gases, helping improve performance and process stability.

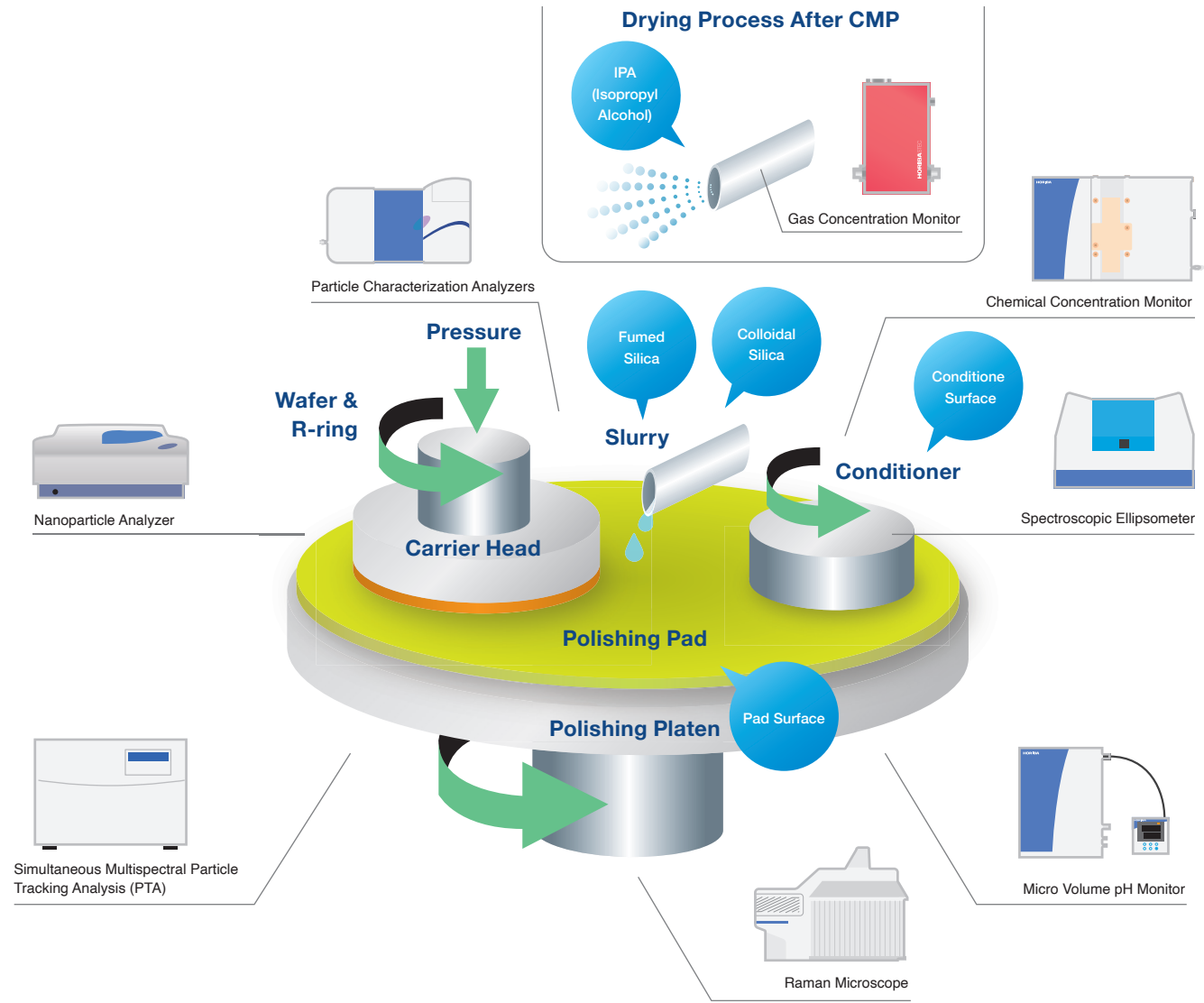
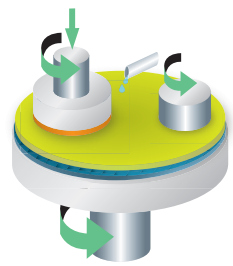


Accuracy data under downstream
pressure conditions of 100 Torr



Chemical Mechanical Polishing (CMP)

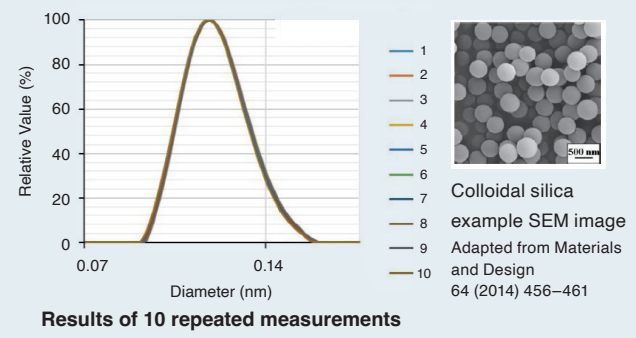
In CMP process, the concentrations of oxidizers and reducers in the slurry, particle size, and pH all affect polishing rate and final surface quality. HORIBA provides measurement instruments needed to monitor slurry solutions, as well as analytical instruments for evaluating wafer damage caused by CMP, contributing to improved CMP yield.



	Particle Characterization Analyzers	Micro Volume pH Monitor	Chemical Concentration Monitor	Flat Carbon Sensor Conductivity Meter	Spectroscopic Ellipsometer	Raman Microscope	NanoRaman Microscope (AFM-Raman)	X-ray Analytical Microscope	Chemical Solution Monitoring System	Dissolved Oxygen Concentration Monitor	Simultaneous Multispectral Particle Tracking Analysis (PTA)	Gas Concentration Monitor
Cleaning			○						○	○		
Missing/Defect						○	○					
Film thickness					○			○				
Slurry properties	○	○				○					○	
Slurry concentration			○	○								
Gas concentration												○

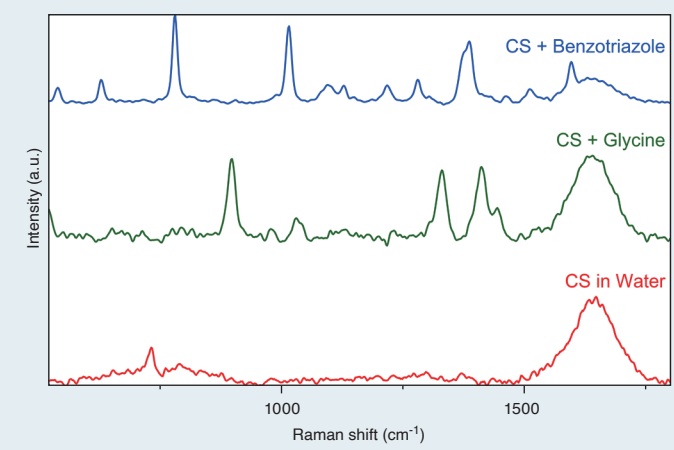
Characterization of CMP Slurry

Colloidal silica used in CMP slurry is a nanoparticle material. The Partica CENTRIFUGE, Centrifugal Nanoparticle Analyzer, can measure particle size distributions with high resolution and excellent reproducibility.

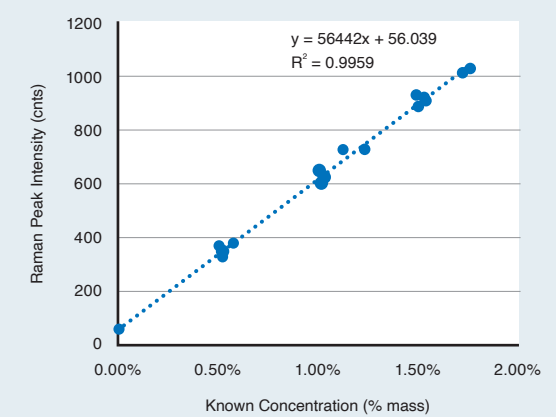


Quantitative Analysis of Components in CMP Slurry

CMP slurry contains various components, including colloidal particles, oxidizers, chelating agents, and corrosion inhibitors, which improve polishing performance. The MacroRAM Benchtop Raman Spectrometer enables quick, simple, and accurate quantification of CMP slurry components, reducing costs and improving usability compared with conventional analytical methods.



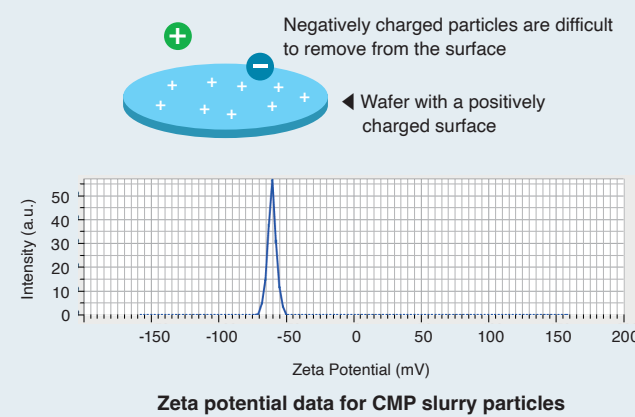
Raman spectra of colloidal silica CMP slurry containing colloidal silica and various additives



Correlation plot obtained by measuring the Raman peak intensity of glycine at 900 cm⁻¹

Zeta Potential Analysis of Polishing Particles in CMP Slurry

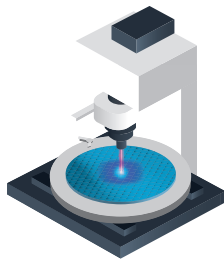
The nanoPartica SZ-100V2 Nanoparticle Analyzer can measure the zeta potential of slurry particles using just 100 µL of sample. In post-CMP cleaning, analyzing residual material on the wafer surface is essential, and zeta potential is one of the key evaluation indicators. By identifying the causes of insufficient cleaning after CMP, it helps achieve a more stable CMP process.





Wafer Inspection

HORIBA has combined its analytical and measurement technologies with fully automated measurement technology to develop imaging-capable measurement systems with automatic transport. These systems provide key wafer parameters in a timely manner, such as film thickness, crystallinity, defects, and particle detection.



	Fully Automated Thin-film Inspection System (Ellipsometer)	Fully Automated Thin-film Inspection System (Raman)	Photoluminescence Mapping System	SiC Wafer Defect Inspection System	Examples of Materials
Film Thickness Meter	○				SiO ₂ , SiN, Low-k, High-k
Optical Constants	○				SiO ₂ , SiN
Stress		○			Si, SiGe
Crystallinity		○	○	○	Si, 2D Materials, GaN, InP
Composition/Uniformity		○	○	○	SiGe, InP, GaN, SiC
Defects			○	○	GaN, SiC

Automated Raman Analysis of Thin Films and Semiconductors

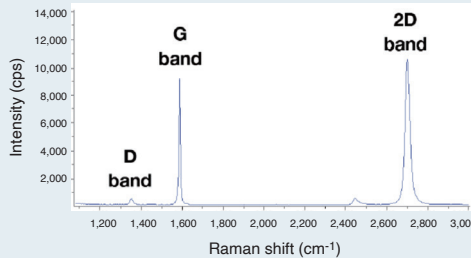
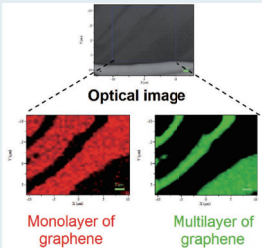
Xtology, Fully Automated Thin-film Inspection System, automatically evaluates thin-film materials. Built around HORIBA's proprietary Raman spectroscopy technology, it enables quantitative, non-destructive, non-contact analysis of layer count, crystallinity, stress, and defects. It provides high-precision evaluation of a wide range of materials, from graphene and other two-dimensional materials to Si/SiC devices. With the high-speed mapping technology SWIFT, it can measure large areas quickly and densely, supporting material evaluation and process development from R&D to mass production.



Fully Automated Inspection System
Xtology

Graphene layer-number identification

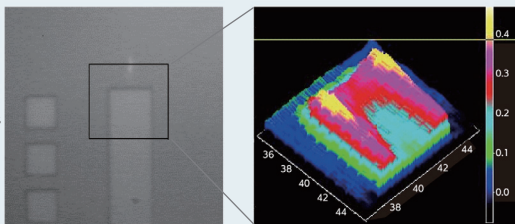
- Monolayer/multilayer discrimination
- 2D/G Band analysis
- High-speed mapping SWIFT
- Non-contact, non-destructive measurement



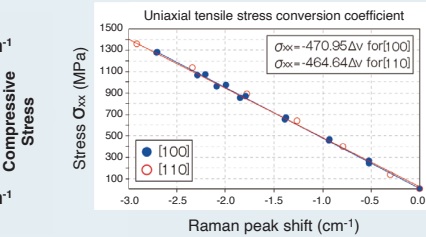
Graphene layer-number mapping: monolayer/multilayer distribution

Si stress mapping

- Visualization of stress distribution
- Raman peak shift analysis
- Internal defect extraction
- Non-destructive, high-resolution measurement



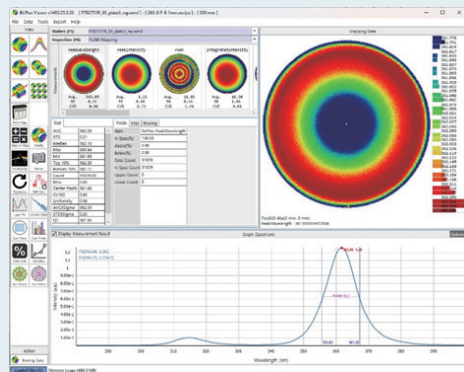
Stress evaluation in a localized Si region



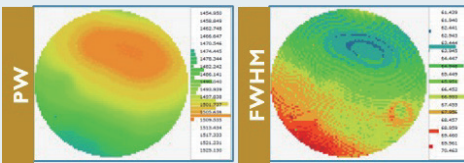
M.Komatsubara, T.Namazu, Y.Nagai, S.Inoue, N.Naka, S.Kashiwagi, K.Ohtsuki : Jpn.J.Appl.phys.48 (2009)04C021

Photoluminescence Mapping System for Compound Semiconductors

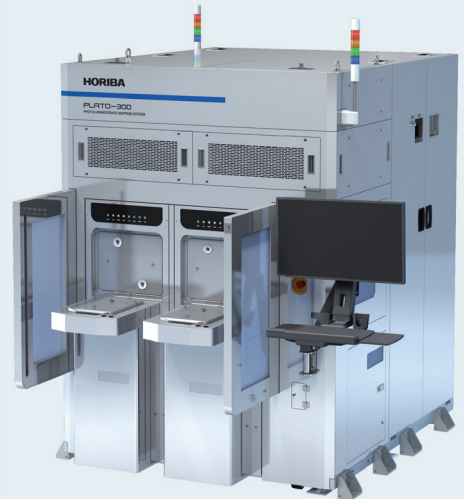
The PLATO Series, Photoluminescence Mapping System, is a compound-semiconductor material characterization system based on photoluminescence (PL) technology. Depending on the excitation laser and spectroscopic method selected, it can measure spectral characteristics from DUV to NIR. It supports 2- to 12-inch wafers, and the lineup includes an auto-loading model for automated handling. By analyzing parameters such as peak wavelength, intensity, film thickness, and wafer warpage, the system helps improve yield.



Data Viewer Software



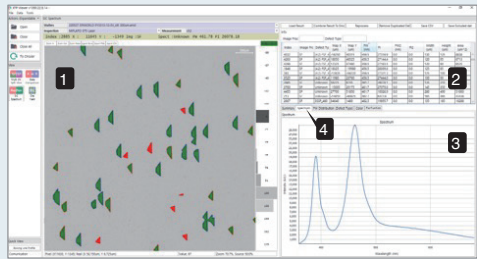
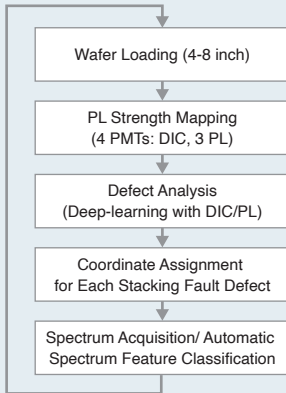
PW/FWHM Wafer Mapping* * PW: Peak Wavelength; FWHM: Full Width at Half Maximum



Photoluminescence Mapping System
PLATO-300

Automated SiC Wafer Defect Inspection and Stacking Fault Classification

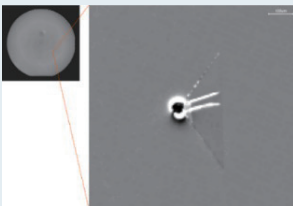
MiPLATO-SiC, the SiC Wafer Defect Inspection System, is a PL mapping system optimized for SiC wafers. Utilizing a spiral mapping method, it acquires microscopic PL images of the entire wafer in a short time. Through real-time data analysis using deep learning capabilities, it creates maps of defect distribution and density, enabling the prediction of yield during device fabrication. Our patented automatic navigation function allows for accurate classification of all stacking faults through wavelength analysis. Furthermore, based on precise location information derived from the defect map, it is possible to perform micro-mapping of carrier lifetime and spectral characteristics in specific regions, as well as macro-mapping across the entire wafer.



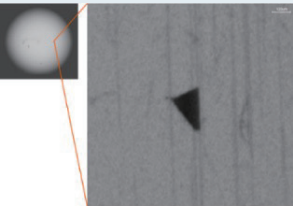
- [1] PMT: Photomultiplier Tube
- [2] Defect List
- [3] SF: Stacking Fault
- [4] Data Analysis Menu



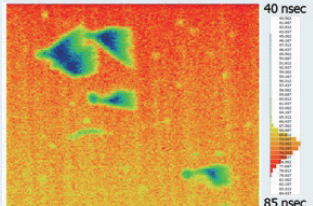
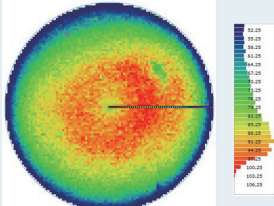
SiC Wafer Defect Inspection System
MiPLATO-SiC



Deep-Learning Based Defect Detection & Classification



Macroscopic Carrier Lifetime Mapping
(Full Wafer)

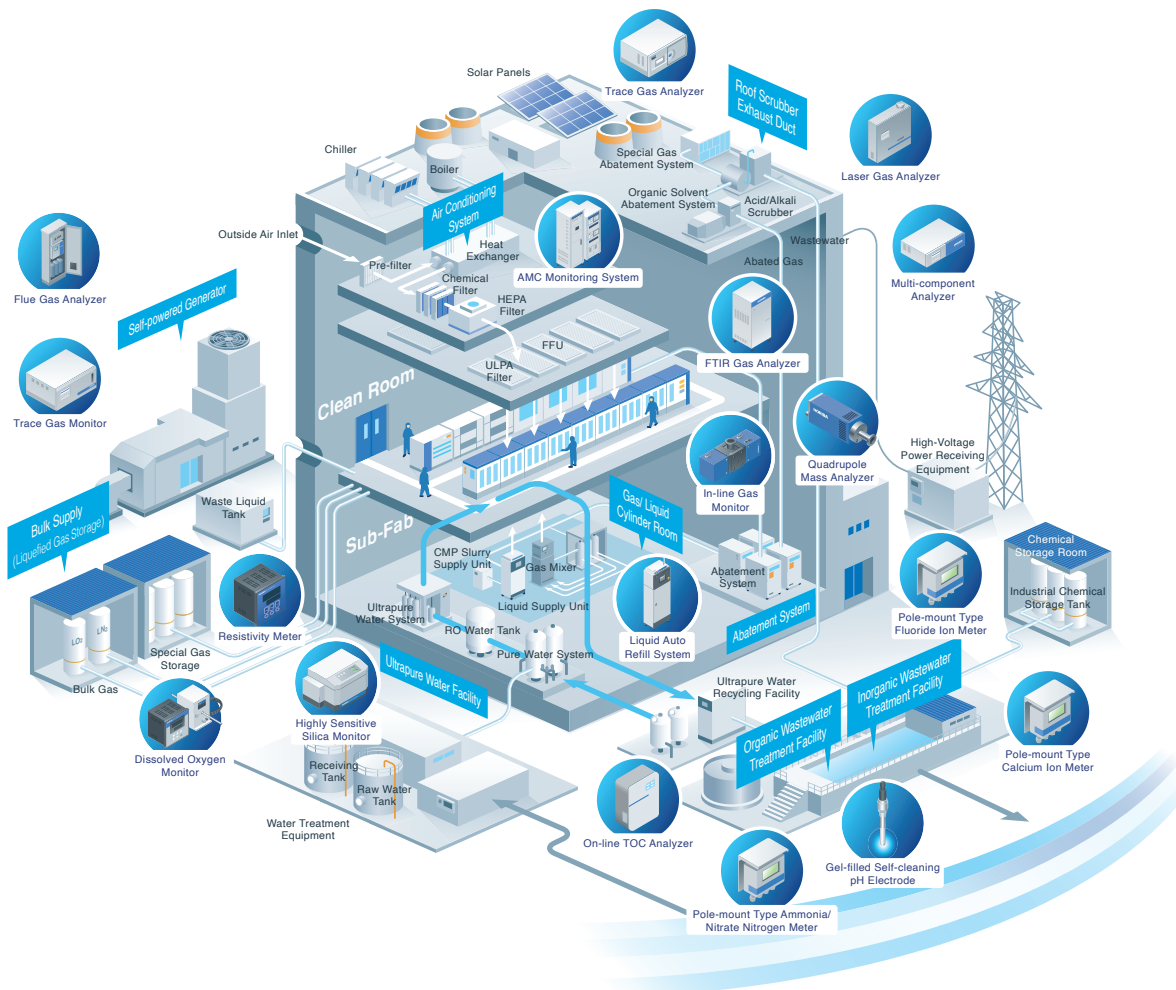


Microscopic Carrier Lifetime Mapping
(Selected Area)



Facility

Facilities are essential for the stable operation of cleanrooms and advanced semiconductor manufacturing equipment. In addition to utilities such as process materials supply, ultrapure water, and air conditioning, energy conservation and renewable energy are becoming increasingly important for sustainable operations. Through its measurement technologies, HORIBA supports stable fab operation and process optimization while helping reduce environmental impact.



Self-powered Generator

Stack Gas Analysis System

Bulk Supply (Liquefied Gas Storage)

Trace Gas Monitor

Ultrapure Water Facility

Ultrapure Water Resistivity Meter
Highly Sensitive Silica Monitor
Pure Water DO Monitor

Air Conditioning System

AMC Monitoring System

Gas/Liquid Cylinder Room

Liquid Auto Refill System

Organic Wastewater Treatment Facility

On-line TOC Analyzer
Gel-filled Self-cleaning pH Electrode
Pole-mount Type Ammonia/ Nitrate Nitrogen Meter

Roof Scrubber

Trace Gas Analyzer
Multi-component Analyzer

POU Abatement

In-line Gas Monitor
Quadrupole Mass Analyzer

Inorganic Wastewater Treatment Facility

Pole-mount Type Fluoride Ion Concentration Meter
Pole-mount Type Calcium Ion Meter
Pocket Water Quality Meters

Control of Ultrapure Water Resistivity at the Point of Use

Ultrapure water is essential in semiconductor manufacturing, and its quality must be ensured at the point of use by measuring electrical resistivity of 18.20 MΩ-cm or higher. However, resistivity measurement is highly sensitive to temperature, and even slight temperature changes can significantly affect accuracy in the ultrapure water range.

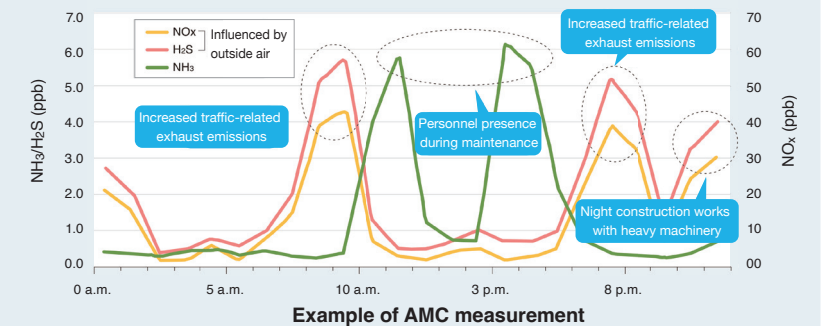
The HE-960RW Resistivity Meter minimizes temperature effects through high-resolution, fast-response temperature measurement combined with advanced temperature compensation.



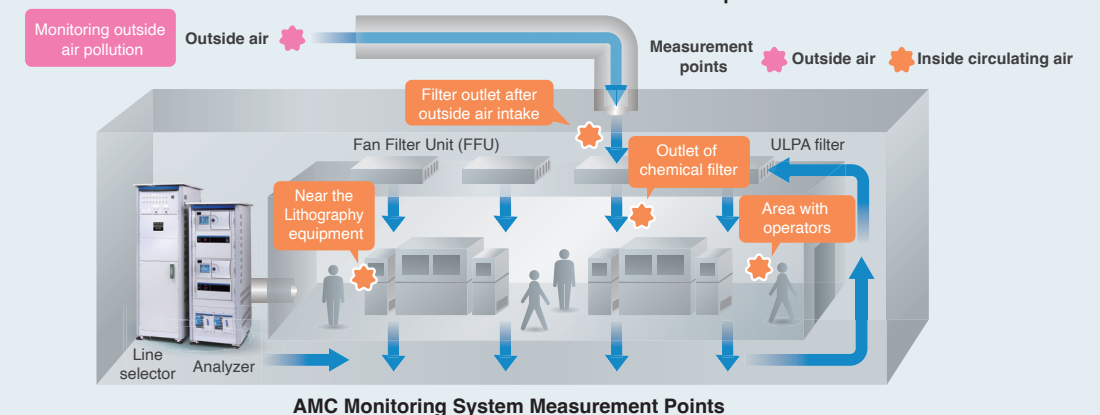
Panel-mount Type Electric Resistivity Meter
HE-960RW

AMC* Monitoring *Airborne Molecular Contaminants

AMCs are airborne molecular contaminants that can significantly affect product quality in modern semiconductor manufacturing, even at ppb-level concentrations. Our AMC Monitoring System enables continuous, multi-point measurement without relying on manual sampling or analyst expertise.

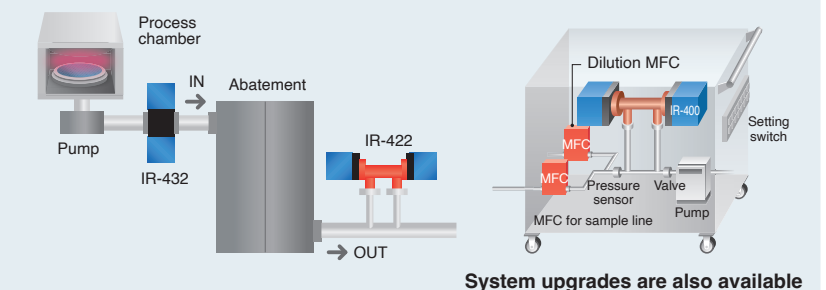


Example of AMC measurement



Analysis of Greenhouse Gas (GHG) Concentrations in Abatement System

Accurate measurement and control of GHG emissions are essential in semiconductor manufacturing facilities. HORIBA's compact IR Series In-line Gas Monitors use non-dispersive infrared (NDIR) technology and can be easily installed in existing exhaust lines or integrated into abatement systems, including high-temperature lines up to 150°C. Real-time gas concentration monitoring enables feedforward/feedback control to optimize equipment operation and reduce energy and resource consumption.



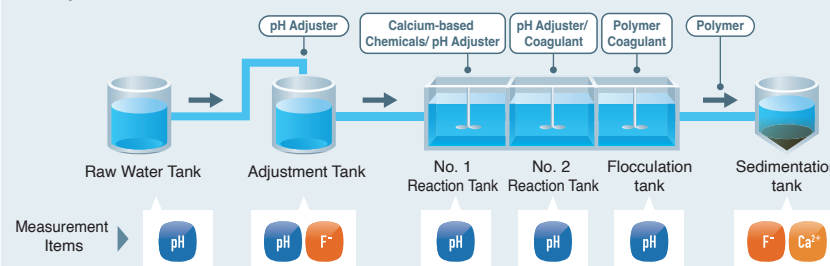
System upgrades are also available

Monitoring of Calcium Ion Concentrations in Hydrofluoric Acid Wastewater

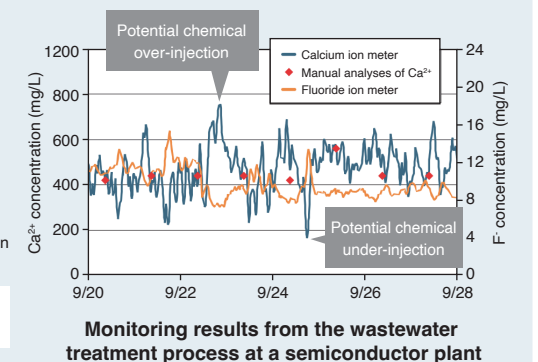
In coagulation and sedimentation—one of the common treatment methods for hydrofluoric acid wastewater—chemical dosing is often fixed. However, fluoride concentration in the wastewater fluctuates depending on the manufacturing process and chemicals used, which can lead to insufficient or excessive dosing. To properly control calcium-based chemical injection, monitoring fluoride ion concentration in the upstream equalization tank is essential. In addition, monitoring calcium ion concentration in the downstream settling tank helps verify whether the dosing was appropriate.

The HC-200CA Calcium Ion Monitor supports optimization of chemical consumption, improving treatment efficiency and reducing operating costs.

► Hydrofluoric Acid Wastewater Treatment Process



Pole-mount Type Fluoride Ion Concentration/Calcium Ion Meter
HC-200F/HC-200CA



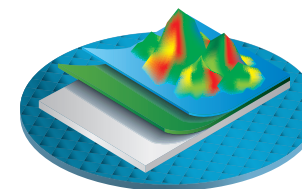
Monitoring results from the wastewater treatment process at a semiconductor plant



Material Characterization

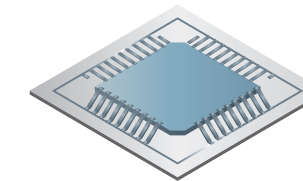
For over 50 years, HORIBA's analytical technologies for material characterization have supported the R&D and manufacturing of advanced semiconductor devices, from material evaluation to final inspection. Used in semiconductor fabs and research institutions, our solutions cover the entire process from ingots to finished devices. With a broad portfolio of measurement technologies, we deliver critical data that improves process efficiency and provide comprehensive support for both R&D and production.

									
	Raman Microscope	NanoRaman Microscope (AFM-Raman)	Photoluminescence Microscope	Spectroscopic Ellipsometer	Cathodoluminescence Analyzer	Fluorescence Spectrometer	O/N/H Analyzer	GD-OES Depth Profiler	X-ray Analytical Microscope
Band-gap			○	○	○	○			
Crystallinity/Stoichiometry	○	○		○					
Defects/Impurities	○	○	○		○				○
Electrical Properties		○							
Elemental Analysis							○	○	○
Film Thickness	○	○		○				○	○
Stress/ Chemical Composition	○	○			○				



Packaging

The XGT-9000 Series is a Microscope-type X-ray Fluorescence (XRF) Analyzer that uses an X-ray guide tube to analyze microscopic areas. HORIBA's proprietary X-ray focusing element generates a thin, high-intensity beam, enabling faster micro-area measurements than conventional collimator-based systems.



	
Elemental Analysis	○
Transmission Analysis	○

HORIBA's Wide Range of Measurement Techniques Caters to Various Materials of Interest, Including:

2D materials	CMP slurries	Quantum dots	Photoresists
Oxides, Nitrides	Compound semiconductors	Organic semiconductors	

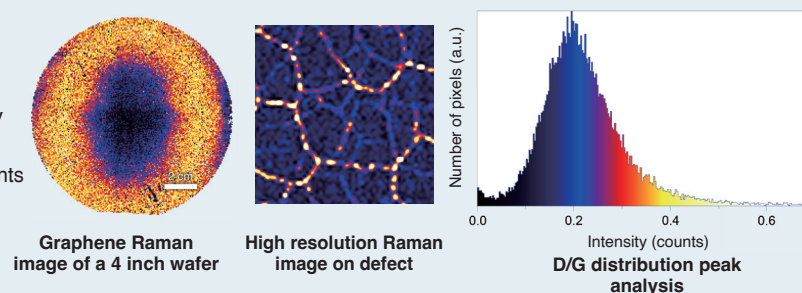
2D Materials

Applications : CMOS, Electrodes, and Barriers

Materials : Graphene, Transition Metal Dichalcogenides, Hexagonal Boron Nitride (h-BN)

Information :

- Layer thickness (Raman, Ellipsometer)
- Crystal quality, Charge carrier concentration, Stoichiometry and Band-gap (Raman, Photoluminescence)
- Defect density, Visualization and identification of contaminants (Raman, Photoluminescence)



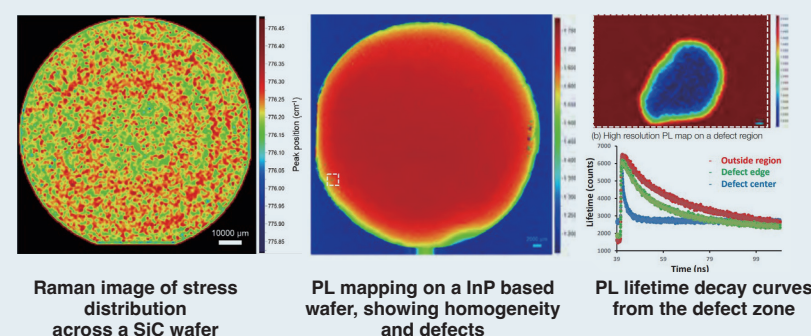
Compound Semiconductors

Applications : Power devices, Displays, LEDs, Laser diodes, Quantum wells

Materials : GaN, SiC, Ga₂O₃, GaAs, InGaAs, InP, etc.

Information :

- Stress & Crystalline structure (Raman)
- Doping level (Raman)
- Carrier lifetime (Time-resolved Photoluminescence)
- Epitaxial layer growth uniformity & Detection of impurities (Photoluminescence)
- Optical constants, Band-gap, Film thickness (Spectroscopic Ellipsometer)
- Elemental analysis in depth (GD-OES)



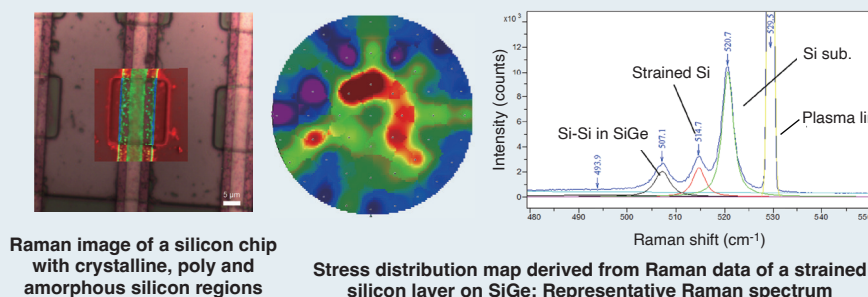
Group IV Semiconductors

Applications : 2D/3D Transistors, Photovoltaics

Materials : Si, Ge, SiGe

Information :

- Optical constants, Band-gap, Film thickness (Spectroscopic Ellipsometer)
- Stress and composition measurements (Raman)
- Phase identification (crystalline, micro-crystalline, amorphous) (Raman)
- Crystallographic defects detection (Raman)



Organic Semiconductors & Perovskites

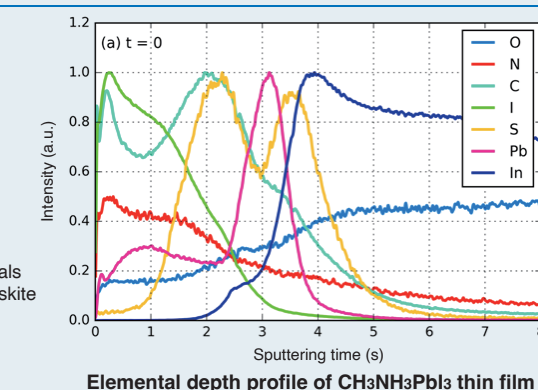
Applications : Solar cells, Photodetectors, Organic light-emitting diodes (OLEDs)

Materials : Perovskites, P3HT, PEDOT:PSS, Alq3, PPV, Pentacene, etc.

Information :

- Identification of molecular structure (Raman)
- Elemental analysis in depth (GD-OES)
- Carrier lifetime (Fluorescence Lifetime Spectroscopy)
- Optical constants, Band-gap, Film thickness (Spectroscopic Ellipsometer)

* Typical materials used in perovskite solar cells



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