PST
PROCESS SENSING
TECHNOLOGIES

Analyzers for Ultra-high Purity Gas Quality Control

For Semiconductor Manufacture

MICHELL Instruments
Analytical Industries Inc
rotronic MEASUREMENT SOLUTIONS
LDetek
DYNAMENT INFRARED GAS SENSORS
NTRON Gas Measurement
SST

Benefit from Trace Oxygen, Moisture, and Impurities Measurements with High-precision Analyzers and Gas Chromatographs

The speciality gases used in manufacturing semiconductors must be high purity because of the detailed precision of the process. Even the presence of trace impurities measured in parts per trillion will result in the loss of whole batches of wafers. We offer reliable, repeatable measurements of key parameters with lower detection limits down to <100 ppt.

Expertise in Products for Semiconductor Manufacture

Our oxygen and moisture analyzers and sensors, together with process gas chromatographs, provide a complete solution to monitor and control the purity of specialty gases and toxic gases such as: nitrogen, helium, argon, hydrogen, tungsten hexafluoride, octafluorocyclobutane, silane, germane, nitrous oxide and nitrogen trifluoride.

Measurement Parameters

- Trace Moisture – LDL of 1 ppb_V with Pura
- Trace O_2 – LDL <100 ppt achievable with PI2-UHP analyzer
- Trace Gases – LDL down to <100 ppt with MultiDetek3 and LD8000 Plus

Benefits

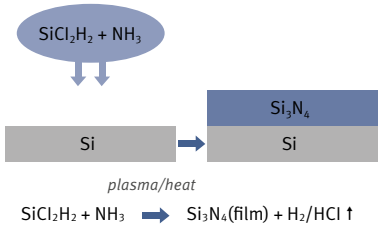
- Reliable measurements of trace impurities down to parts per trillion
- A complete measurement and analysis solution from a single supplier
- Multiple trace impurity measurements possible with a single analyzer system

Selected Served Applications

- Monitoring oxygen and moisture contamination of UHP gases
- Confirming the purity of UHP speciality gases such as in plasma etching of silicon wafers for LCD production
- Heat treating silicon wafers
- Trace N_2 for quality control
- Cleaning processes in chemical vapor deposition chambers
- Ambient monitoring for personnel safety

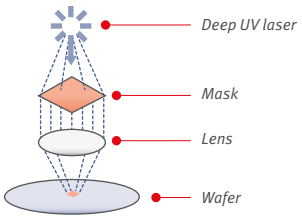
Semiconductor Processes

Deposition



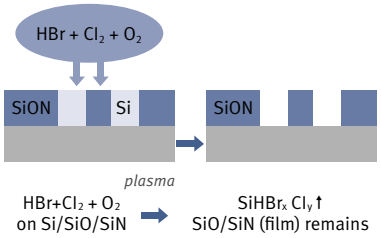
Nitrogen gases: NH_3, N_2O
Silicon gases: SiH_4, Si_2H_6, TCS, HCDS, TMS
Oxygen: O_2
Tungsten hexafluoride: WF_6
Germane: GeH_4

Lithography



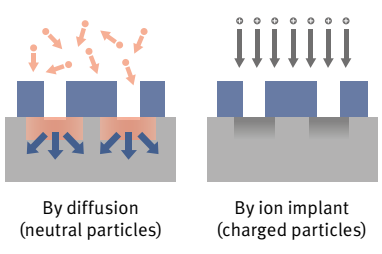
Laser gases: 95+ % Ne, with Ar, Kr, F_2
Carbon dioxide: CO_2
Hydrogen: H_2

Etching



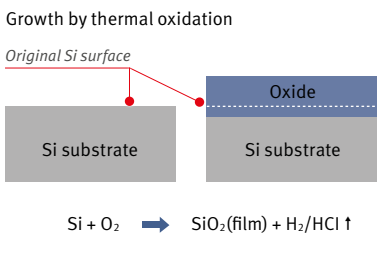
Fluorocarbons: $C_xH_yF_z$ CF_4, C_2F_6, C_3F_8, C_5F_8, C_4F_6, CHF_3, CH_2F_2, CH_3F, C_2HF_5
Sulfur hexafluoride: SF_6
Halides: HCI, CI_2, HF, F_2, HBr, CIF_3, XeF_2
Oxygen: O_2

Doping



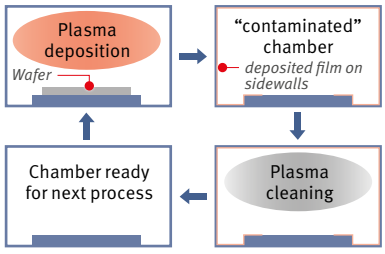
Hydrides: AsH_3, BF_3, B_2H_6, PH_3, GeH_4, Ge_2H_6

Annealing



Oxygen: O_2
Hydrogen: H_2
Argon: Ar

Chamber Cleaning



Nitrogen trifluoride: NF_3
Other fluoride gases: CF_4, C_2F_6, C_4F_8, CIF_3, SF_6
Chloride gases: HCI, CI_2
Fluorine: F_2

Product Selector

Application/Service	Measurement Range	Measured Gas / Background Gas	Recommended Product
Monitoring oxygen contamination of UHP gases	0...100 ppb O_2 LDL <100 ppt (PI2-UHP)	N_2, H_2, Ar	• PI2-UHP100 • PI2-MS1000
Monitoring moisture contamination of UHP and speciality carrier gases	0...100 ppb_V H_2O, 0...10 ppm_V H_2O 50 ppm_V H_2O 100 ppm_V H_2O LDL 1 ppb_V (Pura) -120...-40 °C dew point	Fully fluronated compounds (FFCs), N_2, H_2, Ar etc	• QMA401 • Pura-TX-2W • S8000 RS
Non-invasive leak detection in UHP gas distribution systems with mobile cart to less than 100 ppb O_2	0...100 ppb O_2 0...100 ppb_V H_2O 0...10 ppm_V H_2O 50 ppm_V H_2O 100 ppm_V H_2O -120...-40 °C dew point	N_2, H_2, Ar	• PI2-UHP100 • PI2-MS1000 • Pura-TX-2W • QMA401
Monitoring oxygen contamination of UHP H_2 scavenger gases used in atmosphere soldering and annealing copper films	0...100 ppb O_2	N_2, H_2, Ar	• PI2-UHP1000
Confirming the purity of UHP speciality gases	0...100 ppb LDL 0.1...0.5 ppb	Impurities: H2,Ar,N2,CH4,CO,CO2,NMHC Background: He,Ar,O2,H2,N2,CO2,Si-H4,B2H6,GeH4	• MultiDetek3
Heat treating silicon wafers – Monitoring trace oxygen in wafer oxidation furnaces	0...10 ppm O_2	N_2, H_2	• GPR-1600 • GPR-1200
Inerting in solder reflow ovens and wafer fabrication	<10 ppm O_2	N_2	• Microx 231
Cleaning processes in chemical vapor deposition chambers – monitoring moisture levels after purging with high purity nitrogen	0...100 ppb_V H_2O 0...10 ppm_V H_2O 50 ppm_V H_2O 100 ppm_V H_2O -120...-40 °C dew point	N_2	• Pura-TX-2W • QMA401
Ambient monitoring for personnel safety – personnel protection against O_2 deficiency in confined spaces	<19.5...20.0 $\%O_2$	Air, N_2	• GasSenz
Trace N_2 for quality control	0...50 ppb, 0...500 ppb, 0...1000 ppb LDL <100 ppt	Ar, He	• LD8000 Plus

Trace Impurities Detection in Specialty Gases

A good analytical tool is essential to ensure the quality of the UHP gases used in semi-conductor manufacture. LDetek's ranges of gas chromatograph analyzers allow impurity detection down to sub-ppb levels.

LDetek MultiDetek3 – Modular Process Gas Chromatograph

This compact gas chromatograph combines the functionality of two GCs in one and has the ability to provide online measurements of moisture and O_2.

- Sub ppb trace measurements
- A single analyzer for trace measurement of multiple impurities
- Temperature controlled to ensure maximum accuracy and stability
- Sophisticated data management software and planning platform

Modular design for easy maintenance

LDetek L8000 Plus – Online PPB Trace Nitrogen in Argon/Helium Analyzer

The LD8000+ is designed with the plasma emission detector (patented PED) maintained in an optimized controlled vacuum equilibrium to offer an extended collision energy level. The PED arrangement is designed with a valve network that allow to balance between 3 excitation sources. From each of the excitation source, an algorithm measures the PED response delta to convert that signal into a fast and drift free nitrogen reading. This unique design makes the LD8000+ analyser top of the technology to measure trace nitrogen in sub ppb/ppt.

- Self canceling effect from gas line contamination & surface absorption
- Fast response time
- Interference free
- Reduce the temperature drifting to minimum value
- Improve the limit of detection down to 0.1ppb trace nitrogen

Low sample consumption

LDetek LDGSS – High Purity Gas Stream Selector

Based on high purity connections with a unique diaphragm valve and no dead volume, its unique design brings an easy way to provide clean gas to any process GC and on-line process analyzers.

- Compact design (3U) with 2 to 9 streams configurable
- Connectable to MultiDetek3 for remote control switching and sequence programming
- Options available for high purity or corrosive and toxic gases

Tested and certified leak proof

LDetek LDGDSA – Automatic Gas Dilution System

The LDGDSA is a user-friendly gas dilution system that offers flexibility to automatically generate the desired gas mixtures. The Windows user interface gives the ability to control and monitor the mixtures, flows, pressures and concentrations remotely.

- Automatic calculation of dilution concentrations
- Broad range of dilution ratios (up to 1000 to 1)
- Integrated heated gas purifier to generate ultra-high purity zero gas reference

Automatic pressure controller

Trace Oxygen

A range of galvanic electrochemical or zirconium oxide sensors packaged in a choice of transmitters and analyzers ensures the most appropriate choice per application.

Analytical Industries Inc PI2-UHP 50/100 – Oxygen Analyzer for Ultra-high Purity Gases

Accurate and stable measurements of oxygen down to low parts per billion – with an LDL of less than 100 ppt.

- Cost-effective and reliable electrochemical sensors with 12 months life
- Heated sample system for measurement integrity – negating the diurnal temperature effect
- Auto-calibration system with true zero feature via O_2 scrubber

No electrolyte to regularly top up or replace

Analytical Industries Inc PI2-MS 500/1000 – Oxygen Analyzer for Ultra-high Purity Gases

Accurate and stable measurements of oxygen down to parts per billion.

- Cost-effective and reliable electrochemical sensors with 12 - 24 months life
- Easy to maintain, simple to operate
- Optional auto calibration system with true zero feature via O_2 scrubber

LDL of less than 2.5 ppb

Trace Oxygen

Analytical Industries Inc GPR-1600 – Oxygen Analyzer for Industrial Gas

Monitors oxygen in low parts per million in a variety of background gases.

- Low measurement range 0...10 ppm
- Long sensor life up to 24 months in <1,000 ppm O_2

Analytical Industries Inc GPR-1200 – Portable Trace Oxygen Analyzer

An economical and reliable portable analyzer for accurate measurements of trace oxygen.

- Measurement ranges from 0...10 ppm up to 0...100 %O_2
- Accuracy of better than 2 % of range
- 24 - 32 months sensor life span (in normal use)

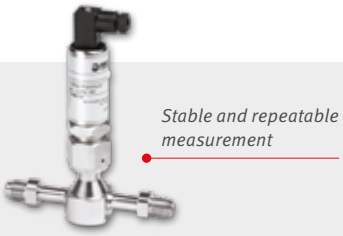
Trace Moisture

Trace moisture measurements are essential for quality assurance in semi-conductor manufacture.

Michell Pura – Pure Gas Trace Moisture Transmitter

Rugged, self-contained hygrometer to measure trace moisture content in ultra-high-purity gases.

- Precision measurement from 0.1...2000 ppm_V
- Low maintenance



Michell S8000 RS – High Precision Chilled Mirror Hygrometer

Highly accurate and repeatable measurements of dew point and humidity. A fully automated auxiliary cooling system ensures minimal operator intervention in measurements.

- Precision measurement to -90 °C dew point (100 ppb) with no need for additional cooling
- Sensor head optimized for fast response to low moisture levels
- Ethernet or USB connections with SD card data logging

Michell QMA401 – Self-Calibrating Trace Moisture Analyzer

Quartz crystal microbalance sensing technology provides reliable, fast and highly accurate measurements of trace moisture.

- Precision measurement from 0.1...2000 ppm_V
- Low maintenance

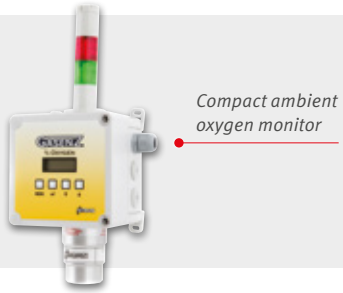
Ambient Monitoring

In confined, enclosed areas where large quantities of gases are used or stored there is a risk that oxygen levels could drop below safe levels for personnel working in the area.

Ntron Gasenz – Ambient Oxygen Analyzer

The Gasenz ambient oxygen monitor is designed for the monitoring of oxygen deficient atmospheres in any work area where the risk of asphyxiation may occur due to the presence of gases like nitrogen, carbon dioxide, argon or helium.

- Long life, low maintenance zirconia, electrochemical or optical sensor technology
- Measurement range: 0...25 %O_2
- Audio/ visual alarm indicator



Process Sensing Technologies

Process Sensing Technologies (PST) provides an unmatched suite of instruments, analyzers and sensors for precision measurements and monitoring in highly demanding end markets. These range from pharmaceutical/ life sciences, speciality gases, semiconductors, O&G, petrochemicals and power to gas detection, food and beverage and building automation.

Using our products, customers save millions of dollars each year through increased energy efficiency in their processes and reduced process disruptions.

The quality of food, medicines, semi-conductors and thousands of manufactured goods depends on reliable measurements of critical parameters such as humidity, oxygen, CO, N_2, H_2, hydrocarbons, pressure or CO_2 during production, storage and transport. Our products directly improve the profitability of our customers and help them to stay compliant with stringent industry regulations. We own and manufacture the sensing technologies used in the majority of our products. This allows us to remain in a strong leadership position and pass on the benefits of our innovation to our customers.

PST Leading Brands

- **Analytical Industries Inc.** – Electrochemical oxygen sensors and gas-analysis
- **Dynament** – Infrared gas sensors
- **LDetek** – Ultra low range online analyzers
- **Michell Instruments** – Moisture and oxygen sensing and instrumentation
- **Ntron Gas Measurement** – Oxygen sensors and analyzers
- **Rotronic** – Humidity and temperature instruments, monitoring systems
- **SST Sensing** – Oxygen sensors and liquid level switches

Group Facts

- Experts in analyzers & systems to ensure purity in semiconductor manufacture
- 22 Service and sales subsidiaries
- 8 global engineering and manufacturing locations
- 100+ authorized distributors
- 14 proprietary technologies

Humidity | *Temperature* | *Dew Point* | *Water Activity* | *Differential Pressure* | *Oxygen* | *CO_2* | *Impurities* | *Flammable Gases* | *Level*

Global direct sales and service support

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