Application Note 6.03

Trace-level dissolved nitrogen (DN2) measurement in ultrapure water and other liquids

- Direct, simple, continuous measurement down to 100 ppb of DN_2
- Solid-state sensor minimizes drift, and reduces typical maintenance requirement to minutes per year
- Needs only 50 ml/min sample flow (or less) for reduced waste
- No interference from CO_2
- Optional add-on dissolved oxygen measurement capability

Application Description

The semiconductor industry is finding an increased need to measure dissolved nitrogen at low concentrations in ultrapure water and other liquids used in wafer fabrication. At present, concentrations of dissolved nitrogen are generally of 1 ppm or higher, but planned improvements in semiconductor devices may require reduction in concentrations to levels well below 1 ppm.

The concern is that DN_2, if present in sufficient concentration, may come out of solution and form small gas bubbles that can be detrimental—or ruinous—to fabricated devices.

In order to satisfy industry requirements for sub-ppm N_2 measurements, Orbisphere has introduced a new DN_2 measurement system with the following special features:

- Patented *spiral* flow chamber insert to maximize linear flow velocity with low flow volume
- Silicone disc to improve sample access to sensor membrane, thereby further reducing flow dependence

The measurement is made by means of a small, solid-state, thermal conductivity sensor that is isolated from the liquid or gas sample by a thin, gas-permeable membrane.

Optional O_2 Measurement

A two-channel version of the trace level dissolved nitrogen measurement system includes O_2 measurement. This cost-effective solution makes a highly accurate correction for the presence of O_2 in trace-level DN_2 measurements, and processes the information on a single indicating instrument. The O_2 sensor uses a simple air-calibration method and requires minimal maintenance.

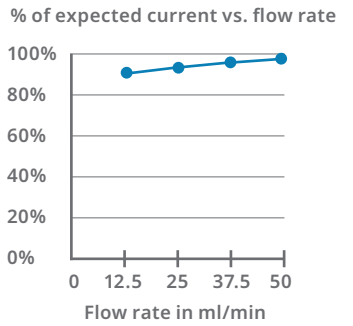
(See also Application Note 6.02, "Dissolved oxygen measurement in ultrapure water for semiconductor manufacturing.")

Installation Recommendations

DN_2 measurement instruments are available in a transportable or panel mount configuration. Measurements are made off-line through a flow chamber (or two, if O_2 is also measured), which is connected to the sample and drain with ¼" or 6-mm tubing. An external temperature sensor is also attached to the sample tubing close to the flow chamber(s). The user may wish to supply flow measurement device on the output side of the flow chamber. Detailed instructions are included with each system.

Flow Dependence

The flow dependence for nitrogen measurement is as follows:



Recommended System Components

Model	Description
511E00/ P1C1P000	Orbisphere 511 Controller N_2 (TC), Panel Mount, 100-240 VAC, 0/4-20mA, Profibus, Ext. Press
31590TC	TC Sensor N2, CO2 Purge , ext temp sensor, 20 bar
32559	External temperature sensor, off-line use with ¼" T-piece
32001.111***	Flow chamber, stainless steel (316), ¼" fittings, Viton o-rings
32505.03**	Sensor cable, length 3 meters (lengths to 500 meters available)

*Without oxygen measurement or correction — to add oxygen measurement and correction, order two of each item marked with two asterisks (**) above, and substitute or add the following:

Model	Description
3610/520	Two-channel N_2 and O_2 analyzer, with alarms, analog outputs, and RS-232 serial outputs
31120.11 (add)	Oxygen sensor

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