Application Note 6.04

Residual oxygen controlled blanketing in the semiconductor industry

- High measurement accuracy helps control blanketing gas for improved quality of silicon wafers
- Continuous residual oxygen measurement ensures reliable blanketing control

Application Description

During the manufacture of integrated circuits, such as VLSI, ULSI, SRAM, DRAM, etc., the IC silicon wafers are heat treated several times to build the circuit gate layers.

One of the important steps in the manufacture of the integrated circuits is the growth of an ultra-thin gate oxide on the silicon wafers. The thickness of the oxide is around 100 Angstroms and must be controlled within very tight limits.

Formation of the oxide layer is accomplished by heating the silicon wafers to 1100 ° C in a controlled oxygen atmosphere, in a vertical furnace. Since silicon oxide is formed even at room temperature in the surrounding air, all air must be excluded from the wafer surface, particularly during transfer of the wafers when they leave the furnace and are still hot (around 400-500 °C).

During transfer, the wafers are blanketed with dust-free, 0.1 micron filtered nitrogen. The oxygen content of the N_2 should be kept below 100 ppm by volume to ,prevent undesired oxide deposits or growth. Clean N_2 is expensive to produce, thus IC manufacturers generally recycle the N_2 used for blanketing. When the O_2 content exceeds the limits, new N_2 is introduced into the blanketing system, maintaining the desired low O_2 level.

The blanketing process is controlled using an oxygen analyzer that continuously measures the residual O_2 present in the N_2 blanketing gas, to detect out-of-limit conditions.

Installation Recommendations

The recommended system uses an Orbisphere 3600 series O_2 analyzer, with a stainless steel O_2 sensor. The system provides alarm relay outputs to signal when the O_2 is out of limits, and is user-programmable.

The O_2 sensor is installed as an off-line measuring device, using a flow chamber to sample the blanketing gas. A single indicating instrument, sensor, and flow chamber configuration allows checking to be performed at several locations within the blanketing system by means of an automatic switching panel. A sample pump is used to transport the gas, via stainless steel tubing, from the different locations to the flow chamber for measurement by the sensor.

The O_2 sensor is equipped with a protection cap, a barrier film, and a metal grill to prevent pressure shock to the membrane during the gas switching operation.

Recommended System Components

Model	Description
510A00/ P1C0P000	Orbisphere 510 Controller O_2 (EC), Panel Mount, 100-240 VAC, 0/4-20mA, External Pressure Sensor Connection
GA2400-S0S	Orbisphere GA2400 Stainless Steel Oxygen Sensor (EC), 100 bar, EPDM O-rings
32001.011	Flow chamber in stainless steel (316) with 1/4” fittings; supplied with Viton O-rings
32505.03	3 meter sensor cable for all thermal conductivity and electrochemical sensors, supplied with two connectors; 10 wires, black sleeve

World Headquarters: Loveland, Colorado USA | hach.com

United States **800-227-4224** fax: 970-669-2932 email: orders@hach.com
Outside United States **970-669-3050** fax: 970-461-3939 email: int@hach.com

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