Ceramicomb-1”™ Dielectric/Conductivity Sensor Specifications

Figure 1
Ceramicomb-1” Dielectric/Conductivity Sensor
(Side exit version shown)

DESCRIPTION

The Ceramicomb-1” is designed for use in presses, molds or harsh environments where a rugged, reusable dielectric/conductivity sensor is desired. It may be mounted so the electrodes are flush with a platen or mold surface, insuring no interference with the flow of material during processing. The sensor is constructed with silver-palladium electrodes embedded in an alumina substrate, protected by a stainless steel sheath with a nominal 1.0” (2.54 cm) diameter. A thermocouple is positioned in the ceramic just below the surface to allow measurement of process temperatures. Dielectric and thermocouple signals are routed through a 10-foot (3 m) long stainless steel conduit to high temperature connectors. Sensor and cabling are rated for operation up to 250 °C and are suitable for R&D, QA/QC and manufacturing applications with repetitive operations.

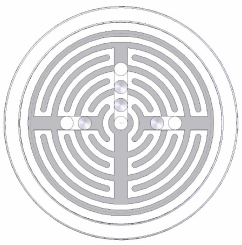

Figure 2: Ceramicomb-1” electrodes

SPECIFICATIONS

Dimensions (available with side or rear exit conduit):

Diameter, sensor head	: 1.0" (2.54 cm) nominal
Height, sensor head	: 1.0" (2.54 cm) nominal
Length, conduit	: 10' (3 m) nominal
Diameter, active face	: 0.69" (1.75 cm)
Width, electrode	: 0.020" (0.5 mm)
Spacing, electrode	: 0.020" (0.5 mm)

Composition:

Ceramic	: Alumina
Electrodes	: Silver-palladium
Sheath/conduit	: Stainless steel
Cabling	: Teflon

Operational:

Temperature, maximum	: 250 °C (480 °F)
Frequency, mid-con mode	: 0.1 Hz – 100 KHz
Frequency, high-con mode	: 0.001 Hz – 100 KHz

Sensor Parameters:

A/D ratio	: 10 cm
Base capacitance	: ~20 pF – 25 pF (actual value may vary)

Thermocouple : Type J standard,
Type K available upon request

Measurement, mid-con mode:

Log Conductivity	: -13 to -4 Log(siemens/cm)
Log Ion Viscosity	: 1 to 13 Log(ohm-cm)
Log Loss Factor	: -1 to 4
Permittivity	: 1 to 10^2 (Not recommended for accurate measurement of permittivity, although trends are indicative)

Measurement, high-con mode:

Log Conductivity	: -10 to -1 Log(siemens/cm)
Log Ion Viscosity	: 1 to 10 Log(ohm-cm)
Log Loss Factor	: 1 to 6
Permittivity	: Not applicable

OPERATING MODES

The Ceramicomb-1” may be used with all Lambient Technologies dielectric instruments in either mid-conductivity or high-conductivity mode. Normally the sensor is making a surface measurement of material between the two interdigitated electrodes, shown close-up in Figure 3. With a special adaptor, the two electrodes can be connected together to emulate a single electrode, for use in bulk measurements with a parallel-plate configuration--in this case the opposite platen or mold wall acts as the second electrode. Please contact customer support for this adaptor.

Figure 3.
Close-up view of Ceramicomb-1” sensor head
(side exit version shown)

FORM FACTORS

The Ceramicomb-1” may be specified with the conduit exiting from the side or the rear as shown in Figure 4.

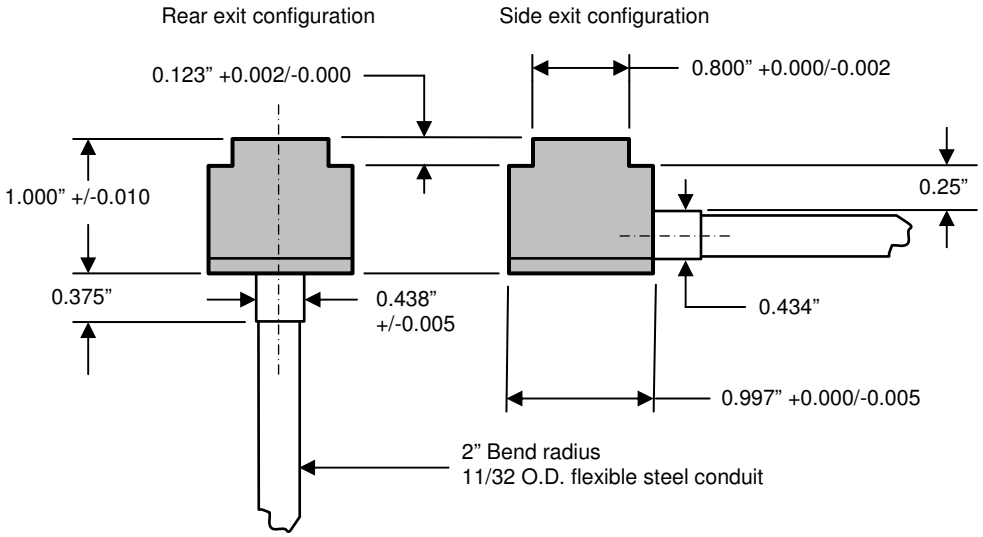

Figure 4.
Sensor form factors

The Ceramicomb-1” has the same form factor as the Micromet Instruments 1” TMS sensor and the NETZSCH Instruments 1” TMS sensor, and is a drop-in replacement for those sensors.

INSTALLATION

The sensor is designed for optimal mounting from the rear side of a mold or platen as shown in Figure 5. The sheath is slightly tapered, and it is recommended that silicone lubricant be applied to the side of the sheath before installation, to facilitate removal when necessary.

Figure 6 shows recommended dimensions for the mounting hole. The drawing indicates a channel for the side exit conduit. In the case of a rear exit conduit, this channel is not necessary.

It is important to support the rear side of the Ceramicomb-1” sensor to prevent high pressures from pushing it into the mold or platen.

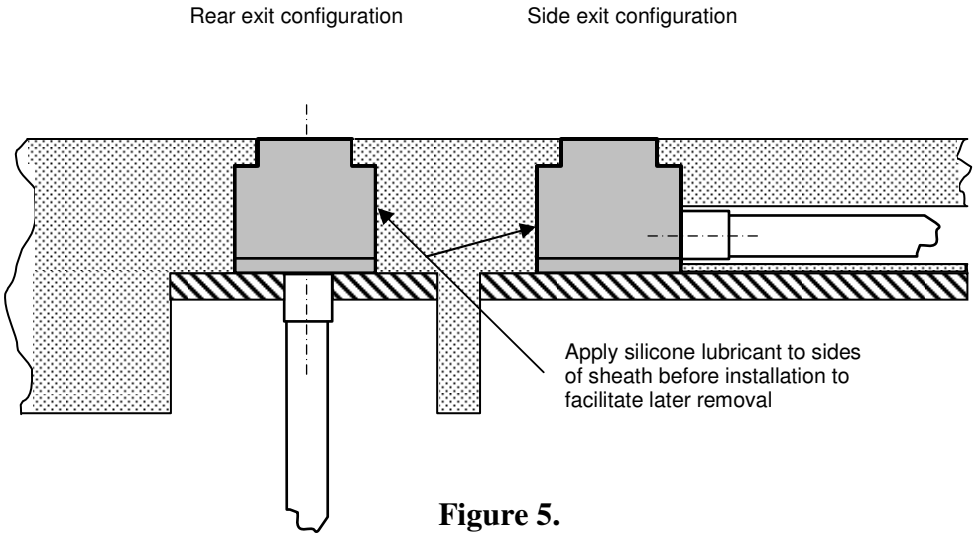

Figure 5.
Sensor installation
Mounting from rear

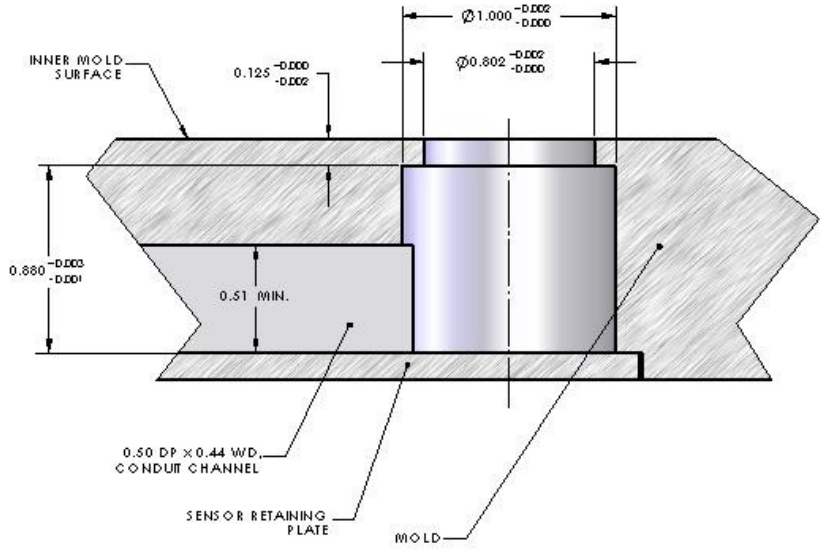

Figure 6.
Machining dimensions for installing Ceramicomb-1” sensor
(All units in inches)

CARE AND HANDLING

Always apply mold release to the surface of the sensor before use with curing material. A silicone based mold-release is recommended to reduce conductive contributions to the measurement. Damage to the sensor may result if mold release is not used and cured material is peeled from the surface.

Avoid dropping the sensor. Do not strike the ceramic with sharp or hard objects. The ceramic material is strong, but brittle.

TEST MEASUREMENT

Sensor parameters:

A /D ratio : 10 cm
Base capacitance : ~20 – 25 pF (value may vary)

Response of a clean, dry sensor in air at 10 Hz, 20°C:

Mid-conductivity mode
Gain : -40 to -30 dB (typ)
Phase : -3° to 3° (typ)

High-conductivity mode
Admittance: $< 10^{-6}$ mohs (typ)
Phase : 10° to 30° (typ)

Results that differ from the above may indicate a sensor that is dirty, moist or damaged. Refer to the following section on cleaning. If the sensor response after cleaning is still outside the typical range, please consult with Lambient Instruments.

CLEANING

Careful use of a spatula or other scraping tool to remove samples will not damage the sensor, provided that mold release was applied to the sensor before curing.

Clean sensors with acetone, trichlorethlyene or other solvent to remove oils and contaminants. Solvents or water adsorbed onto the surface of the ceramic normally will not interfere with cure monitoring because it is released at elevated temperature, and would not be present at typical process temperatures.

At room temperature, however, adsorbed solvent or water will appear as an additional conductive component and may dominate the measurement. In this case the gains in air may be elevated (less negative, approaching 0 dB at low frequencies) and phases may be significantly negative. Heating the sensor above 100 °C for a short time should remove adsorbed material and return the response in air to reference values listed in the **TEST MEASUREMENT** section.

LAY-UP TECHNIQUES

1. Place samples on the sensor, insuring good contact with the electrodes.

2. Solid samples, or solid samples which melt during processing, will require applied pressure. The sensors are designed to withstand high pressures and temperatures up to 250 °C.

3. The thickness of the sample should be at least 0.020” (0.5 mm), otherwise the sensor will also detect air or material on the other side of the sample.

4. Composite materials containing graphite or other conductive fibers will require use of a filter layer to prevent shorting of the electrodes. Glass cloth with small pore size, or fiberglass felt, is recommended for these situations.

INSTRUMENT COMPATIBILITY

Compatible with:

Micromet Instruments/Holometrix-Micromet

Eumetric System II Microdielectrometer
Eumetric System III Microdielectrometer
Eumetric 100A
ICAM 1000/1500/2000
MDE Series 10/20 Cure Monitor

NETZSCH Instruments

DEA 230/1
DEA 230/2
DEA 230/10
DEA 231/1
DEA 231/4

The Ceramicomb-1” dielectric sensor has dimensions that are identical to the Micromet Instruments/NETZSCH Instruments 1” TMS sensor, and is a drop-in replacement for the 1” TMS.

NOTES

1. Scratches and other blemishes on the electrodes do not affect the measurement of dielectric properties.

2. Sensors are tested at elevated temperatures. As a result some discoloration may occur, but does not affect the performance of the sensor.

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