

EXPERT PAPER

Reliable, high-performance ultra-trace gas analysis

The SERVOPRO NanoChrome completes Servomex's single-supplier solution for UHP gases.

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SENSING TECHNOLOGY

GAS
CHROMATOGRAPHY



PLASMA



Specifically designed for the semiconductor manufacture industry, the SERVOPRO NanoChrome delivers ultra-trace, high-reliability monitoring of impurities in a wide range of common background gases.

Detection of these very low-level impurities is essential to the production of ultra-high-purity gases demanded by the semiconductor wafer manufacturing process.

The NanoChrome uses advanced Plasma Emission Detector (PED) sensing technology and sensitive ProPeak software, both of which were specifically developed by Servomex experts.

This provides the NanoChrome with considerable advantages over traditional Flame Ionization Detector (FID), Thermal Conductivity (TCD) and Reduction Gas Detector (RGD) sensing technologies, not only in terms of performance, stability and safety, but also in its ability to reduce ongoing costs.

It is able to measure hydrogen, methane, carbon monoxide, carbon dioxide,

nitrogen, argon and non-methane hydrocarbons in background gases including helium, hydrogen, nitrogen, argon and oxygen.

The PED sensor delivers the capability to accurately measure ultra-trace levels of these impurities in electronic gases without the need for a methanizer or flammable fuel gas.

TCD and FID sensors are long-established and are the most widely used measurement technologies for these applications.

FID technology is commonly used for hydrocarbons analysis, being relatively simple to use and offering a very sensitive, selective and linear measurement.

However, this sensor type uses a flame to burn hydrocarbons, which requires air and hydrocarbon-free hydrogen fuel gas. Increasingly stringent health and safety requirements means concerns over using flammable pure hydrogen have been raised by users. This has led to a search for alternatives to improve safety and reduce the expenses associated with using a fuel gas.

FID sensors are traditionally renowned for sensitivity, with the best FID sensors offering a detection limit between 10 parts per billion (ppb) and 20ppb methane equivalent. This limitation is due to the FID sensor requiring carrier gas, fuel and air to operate, making the sensor more prone to noise from low-level hydrocarbon contamination from those three potential sources.

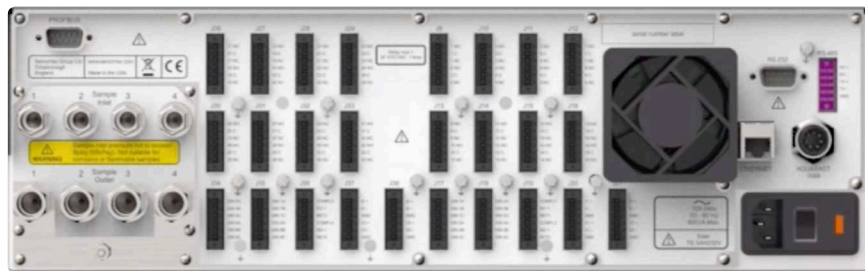
Any hydrocarbons contained in any of these gases are ionized by the sensor, causing drift and noise which limits reliable performance for ultra-trace level measurements.

This level of detection is usually acceptable for General Gas (G-Gas) made before the main purifier, which requires a Lower Detection Limit (LDL) of about 10ppb.

However, the Pure Gas (P-Gas), used inside the fab after the purifier stage, has much lower LDL requirements of 1ppb or less.



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Rear view

ADVANTAGES OF PLASMA EMISSIONS DETECTION

Servomex's PED sensor offers many advantages over FID technology. It is very sensitive and selective to any molecules containing carbons (organic or inorganic), being up to 100 times more sensitive than a FID measurement, depending on the carrier gas.

Using PED sensing, the NanoChrome offers the most stable P-Gas analysis available to the market, even at the lowest levels, along with exceptional sub-ppb measurements of the contaminant gases and hydrocarbons that can be present at ultra-trace levels in semiconductor manufacture.

It also provides an industry-leading LDL of 0.5ppb for impurities in an oxygen background – this includes measurements for CO, CO₂, CH₄ and NMHC.

This analytical sensitivity and ultra-stable reliability is enhanced by advanced signal recovery, utilizing specially developed adaptive chromatographic filtering methods and ProPeak peak detection techniques for a sensitive, selective measurement.

As the PED sensor requires only a carrier gas, external contamination from air and fuel is removed. While it is still very important to have a clean carrier

gas, techniques exist to obtain a clean helium or argon carrier gas with a total impurity level below 1ppb. In addition, avoiding the use of hydrogen and air reduces the cost of ownership, as less gas is consumed and fewer purification systems are required.

There are some limitations to using PED technology. Most notably, the sensitivity of the measurement means it is suitable only for trace analysis applications (<1000 parts per million). Due to the nature of the plasma, the sensor also exhibits some occasional mild cross-interferences due to the sample matrix, which requires more demanding chromatographic methods – also sometimes the case with FID technology.

Overall, however, the PED sensor revolutionizes the analysis of hydrocarbons, CO and CO₂, improving measurement sensitivity, successfully addressing the safety concerns associated with the use of hydrogen and reducing the cost of ownership.

Using a Direct Analysis Methodology, the NanoChrome removes the doubt associated with FID and RGD measurements.

A COMPLETE SINGLE-SUPPLIER SOLUTION

Operators have long relied on accurate Servomex solutions for oxygen and moisture, but had to use a variety of other products to achieve the required measurements for other ultra-trace impurities.

The NanoChrome was developed as an innovative, all-in-one solution that bridged the gap in Servomex's UHP gas analysis offer to create a comprehensive, standalone UHP gas analysis solution.

It has digital communications for remote access and slots easily into fixed racks or mobile carts, including Servomex's multi-gas monitoring system.

When combined with the DF-500 ultra-trace oxygen and DF-700 moisture analyzer series, the NanoChrome ensures Servomex provides the semiconductor industry with a complete, single-supplier solution for reliable UHP gas analysis.

DF-500

HIGH PURITY



DF-700

HIGH PURITY



visit **servomex.com** or contact your local Servomex Business Center.

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