The wafer manufacturing process requires the continuous supply of ultra-pure gases. The smallest of impurities can cause major defects in a circuit, causing scrap or costly re-working of a wafer. To avoid contamination, semiconductor manufacturers employ a variety of resources including strict gas supplier specifications, redundant gas purification techniques, real-time continuous gas purity monitoring and post-process inspection to ensure gases do not contaminate the manufacturing process.

Servomex offers semiconductor manufacturers a complete set of analyzers and systems to continuously monitor their process gases post purifier, mid-stream or at the end of the process lines. This unique solution can continuously monitor all critical process gases including Oxygen (O₂), Nitrogen (N₂), Hydrogen (H₂), Helium (He), Argon (Ar), Carbon Monoxide (CO), Carbon Dioxide (CO₂) and more, enabling users to monitor all major process impurities including Oxygen (O₂), Moisture (H₂O), Methane (CH₄), Non-methanate Hydrocarbons (NMHC) and many others as low as the part-per-trillion (ppt) detection levels.

Servomex also offers the customer a turn-key Continuous Quality Control (CQC) system designed to meet specific customer requirements. Complete with a Servomex proprietary software package to collect and trend real-time gas analysis data, we are the only company to offer a full suite of technologies and CQC systems to meet every impurity analysis need of the wafer manufacturing process.
1. PRE-PURIFIER
BULK GAS SUPPLY

Gases are supplied to the semiconductor customer from one of a variety of industrial gas suppliers. They are supplied in multiple forms including from an on-site ASU, bulk tube trailers and bulk tanks. These gases are designed to meet a specific purity grade from the industrial gas supplier but are typically monitored at their point of production or entry into the facility.

A full set of analyzers can typically be found at the ASU location in a control room operated by the industrial gas company. Some semiconductor end-users may also require a rack of analyzers to be installed at the point of use for the tube trailers or bulk tanks.

2. POST-PURIFIER
BULK PURIFIERS

Bulk gases are sent through various gas purification techniques. These include bulk (house) purifiers that purify large flows of gas as they enter the building, or point-of-use (POU) purifiers that purify smaller quantities of gas before they enter the process equipment. Many leading semiconductor companies employ both bulk and POU purifiers to ensure that they have the most pure gases prior to entering the process environment.

Stationary analytical systems are installed at multiple locations in a large wafer manufacturing facility. They will typically contain multiple analyzers for each bulk process gas. It is common to have 10-20 analyzers installed in each stationary analytical system to monitor the bulk gases post-purifier. Each stationary analytical system is integrated and digitally connected to the building management system to collect and trend gas purity data.

3. MOBILE ANALYTICAL CARTS

Widely utilized at most wafer manufacturing locations, mobile analytical carts are used for multiple purposes to ensure the quality of specific gas line installations.

Each new gas line installed in a semiconductor plant must be "qualified" prior to being used in production. This qualification process includes testing of various parameters of the new gas line including impurity analysis.

A semiconductor plant may have multiple mobile analytical carts so multiple new gas lines and/or process tools can be qualified simultaneously. In addition mobile analytical carts are used to determine the root cause of process upsets and during maintenance activities as the process gas impurities must be below threshold before manufacturing can be restarted.

APPLICATION MEASUREMENT

1. ASU – On-site ASU gas supplies may require all typical ASU measurements that Servomex offers (see ASU process map).
2. Pre-Purifier – Quality control measurements for all bulk gas impurities
   - MonoExact DF310E for O₂ impurities
   - DF-550 or DF-560 for O₂ impurities
   - DF-749 or DF-750 for moisture impurities
   - DF-760 for O₂ and moisture impurities
   - Chroma or NanoChrome for other impurities such as CH₄, NMHC, CO, CO₂, organics, etc.
3. Post-Purifier – Quality control measurements for all bulk gas impurities at the stationary analytical systems and mobile analytical carts
   - MonoExact DF310E for O₂ impurities
   - DF-550 or DF-560 for O₂ impurities
   - DF-749 or DF-750 for moisture impurities
   - DF-760 for O₂ and moisture impurities
   - Chroma or NanoChrome for other impurities such as CH₄, NMHC, CO, CO₂, organics, etc.