Microelectronics

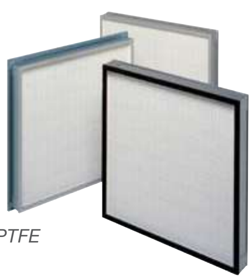
Improve Yield and Reduce Risk

Proper deployment of particulate and gaseous filtration systems in semiconductor manufacturing will:

- Maintain high levels of component dependability
- Reduce unplanned shutdowns to avoid potentially large business and financial losses
- Reduce failures due to:
  - Obstruction of cooling airflow
  - Interference with moving or optical parts
  - Deformation of surfaces
  - Corrosion of electrical components
  - Impedance changes
  - Circuit conductor bridging

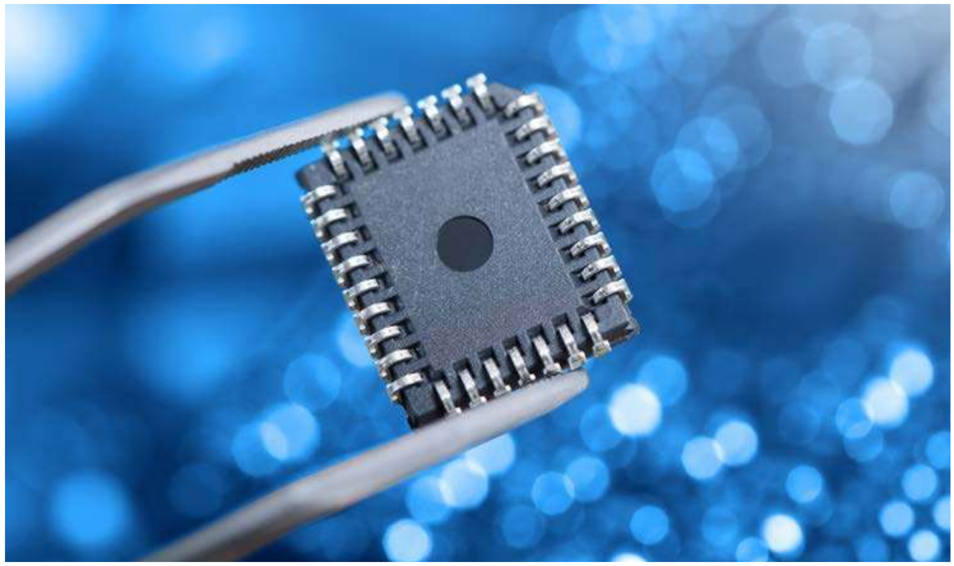
Filtration Solutions

VisionAir™ Clean/ SAAF™ Tech Tools
(see pages 69 and 72)



MEGAcel® II ePTFE
(see page 179)

Gas-Phase Products
(see page 211)



Critical Importance of Indoor Air Quality (IAQ)

Air quality within high-yield, low-reject semiconductor manufacturing facilities is more important than ever. Particulate and corrosive gaseous contaminants have become a serious problem in these facilities. Contaminants enter the facilities in a variety of ways, including outdoor ventilation systems, adjacent interior areas, and with individuals entering and exiting.

Manufacturing memory chips, wafers, and other microelectronic components requires a very precise and exacting process. The conducting pathways that form a circuit on a chip or wafer continue to grow more narrow and closer to each other, which helps increase the processing speed of the chip. The distance between lines etched on modern chips is now measured in nanometers. ULPA filters, (U15 or higher per EN1822), the terminal filter of choice for chip manufacturing, provide the extreme efficiency required to prevent a dust speck from landing on two lines, causing a short-circuiting event that would negatively affect performance.

Controlling Risks from Airborne Molecular Contamination (AMC)

AMCs also presents problems for semiconductor manufacturers. Phosphorus, boron, arsenic, and antimony, collectively known as dopants, are used in the manufacturing process to alter the conductivity of certain parts of the chip. Any extraneous dopant in the environment results in more than the precise amount required by the manufacturer, ruining the finished component. Conventional boro-silicate glass filter media may contribute unwanted quantities of boron. This side effect drove the development and adoption of boron-free expanded PolyTetraFluoroEthylene (ePTFE) media filters as the preferred filter to situate over semiconductor tools. Combined with phosphorus-free polyurethane sealant, ePTFE filters prevent the exposure of microchips to damaging chemicals during the manufacturing process.

Additionally, sulfur-bearing AMCs such as sulfur dioxide (SO_2) and hydrogen sulfide (H_2S) present the risk of corrosion to equipment. These gaseous contaminants lead to deterioration of copper surfaces and silver solder used on circuit boards, leading to failures by either impeding the flow of electricity or forming unintended circuit paths. Elimination of corrosive contaminants is therefore essential in maintaining equipment reliability. Along with boron-free HEPA and ULPA filters, gas-phase filtration is recommended to control AMCs in microelectronics manufacturing facilities.

Microelectronics

Aerospace

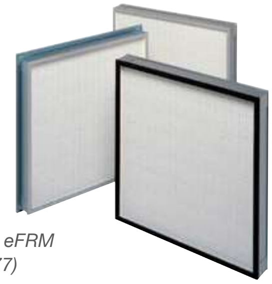
Controlling Critical Issues

Objects and equipment bound for interplanetary travel or orbits must be protected against extremely harsh conditions. Aerospace cleanroom designers need to control two critical issues:

- Molecule contamination occurs when molecular components (AMCs) come to rest on sensitive electrical or optical components, damaging them or resulting in lower resolution optics
- Particle contamination can occur when extraneous AMCs or particles compromise optics and electronics during assembly. A speck of dust, a hair follicle, or a fingerprint can compromise sensitive components

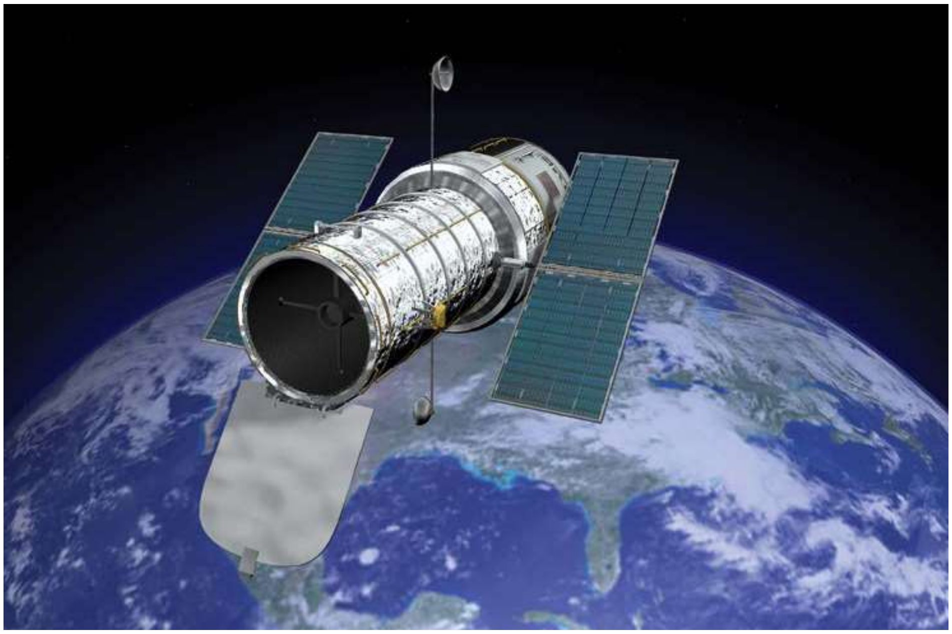
Filtration Solutions

MEGAcel® I eFRM
(see page 161)



MEGAcel® II eFRM
(see page 177)

Gas-Phase Products
(see page 211)



Protection in Extremely Harsh Conditions

Assembly of aerospace components can range from small electronic components to objects large enough to be carried in a mission's payload, such as the Hubble Space Telescope. NASA's Goddard Space Flight Center houses an example of such an aerospace cleanroom. This Greenbelt, MD facility contains a HEPA filter-supplied, horizontal flow, ISO 7 cleanroom.

In aerospace, cleanroom designers need to control for two critical issues: molecular and particle contamination. Objects and equipment bound for interplanetary travel or orbits around celestial bodies must be protected against extremely harsh conditions much more severe than that experienced on Earth. Take, for example, the aforementioned NASA's Hubble Space Telescope. When orbiting the earth, the telescope must withstand widely variable temperature swings. The energy of the sun will heat it to temperatures that can literally boil components. During preparations for launch, susceptible components must be heated in a vacuum chamber to eliminate off-gassing of these materials. If not removed, these molecular components (AMCs) can come to rest on sensitive electrical or optical components, damaging them or resulting in lower resolution optics.

Reducing the Risk to Sensitive Components

Particle control represents a major concern as well. The same optics and electronics require protection during assembly, or extraneous AMCs or particles can damage multimillion-dollar projects. To compound the problem, this damage caused by contamination is almost impossible to correct once a spacecraft is launched. A speck of dust, a hair follicle, or a fingerprint can compromise sensitive components. The assembly of aerospace devices and components takes place in a cleanroom to protect against such contaminants. The HEPA and AMC filters supplied in critical aerospace applications prevent these potential problems from occurring.