



MISSION CRITICAL PRECISION

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Technical White Paper: Enabling UHP Gas Filtration for Advanced Materials in Semiconductor Manufacturing

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Introduction

As semiconductor manufacturers push the boundaries of scaling (Moore's Law), they are simultaneously embracing "More than Moore" strategies - introducing novel materials and device architectures that expand performance beyond simple node shrink. One emerging trend is the replacement of tungsten (W) with molybdenum (Mo) metal for contact and interconnect layers. Molybdenum offers improved conductivity, electromigration resistance, and process compatibility when deposited at ultra-thin scales - often just a few nanometers thick.

This shift requires Atomic Layer Deposition (ALD) of molybdenum from solid precursors with extremely low vapor pressures, stored and vaporized in heated containers integrated into the OEM-platform. These precursors are highly corrosive, demanding exceptional filtration performance and chemical resistance. Mott Corporation's GasShield® HiFlow™ Sandwich Filter - featuring C-22 metal fiber media - is uniquely engineered to meet this challenge, enabling safe and effective delivery of moly precursors while protecting critical downstream components and maintaining ultra-high purity (UHP) standards.

Compact Design for ALD-Centric Process Environments

Mott's GasShield® HiFlow™ Sandwich Filter incorporates a low-profile, sandwich-style design (1.12" x 1.12" x 0.49") that enables seamless integration into space-constrained gas panels, on-tool gas boxes, and hot-zone precursor vaporization modules. It was specifically developed for next-generation OEMs and fabs navigating increased process complexity, material diversification, and real estate limitations within the subfab gas cabinets, valve manifold boxes, and onboard process tool gas panels.

Engineered for Advanced Material Delivery

The GasShield® HiFlow™ Sandwich Filter is optimized for challenging ALD and CVD precursor delivery, including low vapor pressure, corrosive chemistries such as those used for Mo and other emerging materials. The C-22 alloy fiber media delivers high filtration efficiency with enhanced corrosion resistance — critical for precursors that degrade stainless steel or elastomeric components.

Key Technical Features

- **>9 LRV Particle Retention at 1.5 nm**
 - » Validated at the most penetrating particle size (0.08 μm) per SEMI F38-0720.
 - » Enables <1 particle/ ft^3 performance downstream, confirmed per SEMI F43-0308.
- **All-Metal, Welded Construction**
 - » Zero particle shedding, zero outgassing.
 - » Material options: 316L stainless steel or Hastelloy® C-22 (UNS N06022) for aggressive chemistries.
- **Optimized for Precursor Transport**
 - » Compatible with solid precursor vapors for ALD of moly metal, including:
 - MoCl_5 , MoO_2Cl_2 , HfCl_4 , WCl_6 , AlCl_3 , and other corrosive material.
 - » Resilient under high-temperature precursor lines (up to 460°C).
- **Low Pressure Drop Across Flow Range**
 - » 25–35% lower ΔP compared to conventional mesh or pleated disc filters.
 - » Reduces burden on mass flow controllers (MFCs) and maintains stable precursor delivery.
- **Ultra-Tight Tolerances**
 - » $\leq 2\%$ part-to-part flow variation (Kv), supporting advanced process control schemes.
- **UHP Processing & Validation**
 - » Helium leak rate: $<1 \times 10^{-9}$ atm-cc/sec.
 - » Moisture: <10 ppb (SEMI F27).
 - » Total Hydrocarbons: Below detection limits (SEMI-SPEC 90120396B).
 - » Cleaned, welded, and packaged in ISO Class 4 UHP-certified cleanroom.

Applications in Leading-Edge Semiconductor Manufacturing

- The GasShield® HiFlow™ Sandwich Filter is ideally suited for UHP gas and precursor systems across:
- Atomic Layer Deposition (ALD) liquid or solid precursor delivery systems such as molybdenum, hafnium oxide, and other critical thin film materials.
- Low pressure specialty gases used in advanced CVD and etch process chambers
- Subfab gas cabinets, valve manifold gases, and on-tool gas panels where space is at a premium and performance cannot be compromised.

Ordering Information

Material	Part Description	Part Number	Fitting Type	Width	Length	Height
316L SS	6700S-1.120-.490-01	6700065	C-Seal	1.12" (28.45mm)	1.12" (28.45mm)	0.49" (12.45mm)
Alloy 22	6700S-1.120-.490-1E	6700066	C-Seal	1.12" (28.45mm)	1.12" (28.45mm)	0.49" (12.45mm)

*W-Seal and custom designs/fittings available. Contact a Mott representative for more information.

Reliability and Warranty

Backed by a 5-year performance warranty, the GasShield® HiFlow™ Sandwich Filter is qualified for UHP semiconductor service and meets or exceeds industry reliability standards for long-term process stability, even in precursor delivery systems with challenging thermal and chemical loads.

Conclusion

As the industry embraces More than Moore innovation - integrating new materials like molybdenum metal to enable next-gen performance - filtration technology must evolve to support these transformations. Mott's GasShield® HiFlow™ Sandwich Filter with C-22 fiber media provides unmatched retention, corrosion resistance, and pressure performance in an ultra-compact form. It is a critical enabler for OEMs and fabs building the future of semiconductor technology - from logic device scaling to material innovation.

Contact Us

For integration support, datasheets, or qualification samples:
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