

MAGRON CO., LTD.

Pioneering Ferrofluid Technology for the Semiconductor & Vacuum Industries

MAGRON MFF-M Grade PFPE Ferrofluid

World-Class Performance for Semiconductor & Vacuum Applications

PFPE Ferrofluid featuring world-leading vapor pressure, heat resistance, chemical resistance, and vacuum stability

- ★ Industry-Leading Heat Resistance — approx. 100°C higher than global competitors
- ★ Ultra-Low Vapor Pressure — 1.51×10^{-10} Pa (1.13×10^{-12} Torr) at 20°C
- ★ Hermetic Sealing — Helium leak rate below 1×10^{-11} Torr·L/s

1. Executive Summary

MAGRON CO., LTD. is a Republic of Korea-based specialized manufacturer of ferrofluid products, built on its proprietary technology to synthesize high-molecular-weight PFPE (Perfluoropolyether) base fluids in-house. Leveraging this core capability, MAGRON delivers a ferrofluid product line with world-leading heat resistance, chemical resistance, and durability.

- **Triple Crown Performance:** The only product line that simultaneously achieves approximately 100°C higher heat resistance than competitors, ultra-low vapor pressure, and a helium leak rate below 1×10^{-11} Torr·L/s.
- **Chemical Inertness:** PFPE-based superior chemical resistance enables stable operation in corrosive (active) gas environments such as semiconductor etching, CVD, and PVD processes.

2. Six Core Strengths

2-1. Excellent Vapor Pressure Performance

Measured values according to KOPTRI (Korea Polymer Testing & Research Institute) Test Report No. 25-09458, based on OECD Test Guideline 104 (Effusion method):

Temperature	Vapor Pressure (Pa)	Vapor Pressure (Torr)
20°C	1.51×10^{-10} Pa	1.13×10^{-12} Torr
25°C	4.20×10^{-10} Pa	—
100°C	7.57×10^{-5} Pa	5.68×10^{-7} Torr
200°C	1.97×10^0 Pa	1.48×10^{-2} Torr

► Competitor Comparison

Company	Model	Measurement Basis	20°C	100°C
MAGRON (Korea)	MFF-M4251	Finished Product	1.51 × 10 ⁻¹⁰ Pa 1.13 × 10 ⁻¹² Torr	7.57 × 10 ⁻⁵ Pa 5.68 × 10 ⁻⁷ Torr
Sigma Hi Chemical (Japan)	F-310	—	7 × 10 ⁻⁸ Pa	No Data
MFtech (Japan)	MFF-03	Base Oil only	2 × 10 ⁻⁹ Pa	5 × 10 ⁻³ Pa
Liquids Research (UK)	F-9	Base Oil only	7 × 10 ⁻⁸ Torr	1 × 10 ⁻³ Torr
★ Key Insight: MAGRON's values are measured on the finished product, whereas competitors report figures based on base oil only — yet MAGRON's vapor pressure performance remains overwhelmingly superior. This easily satisfies the demanding requirements of semiconductor processes and minimizes chamber contamination sources such as moisture, organics, and oxygen.				

2-2. World-Leading Heat Resistance

Results from TGA (Thermo-Gravimetric Analysis), measured by KITECH at a heating rate of 10°C/min:

► Active-Gas PFPE Ferrofluid — Critical Weight-Loss Temperature Comparison

Model	1% Weight Loss	2% Weight Loss	5% Weight Loss
MAGRON MFF-M4251	282°C	310°C	324°C
MAGRON MFF-M5070	280°C	305°C	323°C
Liquids Research F9 (UK)	176°C	201°C	233°C
MFtech MFF-03 (Japan)	185°C	210°C	237°C
Sigma Hi Chemical F-310 (Japan)	158°C	194°C	241°C

► Weight Loss at 300°C

Model	Weight Loss at 300°C	Performance Rank
MAGRON MFF-M4251	-1.450 %	★ World-Class
MAGRON MFF-M5070	-1.560 %	★ World-Class
Liquids Research F9 (UK)	-21.856 %	—
Sigma Hi Chemical F-310 (Japan)	-21.148 %	—
MFtech MFF-03 (Japan)	-34.648 %	—

► Inert-Gas Lineup (MFS / MFH Series)

Model	Carrier Fluid	Gauss / cP @ 27°C	1% Loss Temp.	5% Loss Temp.
MAGRON MFS-4005	Silicone	400 / 500	196°C	251°C
MAGRON MFS-6022 (MFS-630)	Silicone	600 / 2,200	199°C	236°C
MAGRON MFH-5002 (MFH-503)	Hydrocarbon	500 / 210	168°C	222°C
★ Conclusion: MAGRON offers heat resistance approximately 100°C higher than competitors. This is attributable to MAGRON's advanced, in-house-synthesized high-molecular-weight base fluid — a much larger molecular weight than conventional PFPE — a unique core technology of MAGRON.				

2-3. Fast Vacuum Pump-Down

- **Reduced Pump Load:** Ultra-low vapor pressure (on the order of 10^{-10} Pa) minimizes vacuum-pump load and shortens the time required to reach the target vacuum level.
- **No Outgassing:** Volatile components are virtually absent, eliminating outgassing and preventing chamber contamination during the initial pump-down stage.
- **Higher Throughput:** Rapid transition into the process cycle translates into improved throughput and increased production output per unit time.

2-4. Stable Vacuum Maintenance During Operation

- **Hermetic Sealing:** Helium leak rate below 1×10^{-11} Torr·L/s — both models passed gas-sealing and dust-sealing tests.
- **No Leak Hunting:** Stable sealing performance with no vacuum-level fluctuation during long-term operation, ensuring process reproducibility.

Model	Helium Leak Rate	Gas Sealing	Dust Sealing
MAGRON MFF-M4251	$< 1 \times 10^{-11}$ Torr·L/s	Pass	Pass
MAGRON MFF-M5070	$< 1 \times 10^{-11}$ Torr·L/s	Pass	Pass

2-5. Excellent Chemical Resistance

- **Inert to Harsh Chemistry:** Built on a PFPE (Perfluoropolyether) backbone, the product is chemically inert to strong acids, strong bases, oxidizing gases, and corrosive (active) gases.
- **High Bond Strength:** The use of a high-molecular-weight base fluid yields stronger chemical bonds than conventional PFPE, providing superior decomposition resistance.
- **Semiconductor-Ready:** Operates stably for extended periods even in the corrosive plasma environments of semiconductor etch / CVD / PVD processes.

2-6. Outstanding Durability

- **Shear & Thermal Resistance:** Long molecular chains of the high-molecular-weight PFPE base provide strong resistance to mechanical shear and thermal degradation.
- **Extended Service Life:** Reduced magnetic-particle aggregation and loss extend sealing service life.
- **Lower TCO:** Longer maintenance cycles result in a lower Total Cost of Ownership (TCO) for the customer.

3. Product Lineup Specifications

Model	Carrier	Ms (Gauss)	Viscosity (cP @ 27°C)	Environment	Typical Application
MFF-M4251	PFPE	420	5,100	Active Gas	Etch / CVD / PVD chambers

MFF-M5070	PFPE	500	7,000	Active Gas	High-load active-gas sealing
MFS-4005	Silicone	400	500	Inert Gas	General vacuum, robotics
MFS-6022	Silicone	600	2,200	Inert Gas	High-magnetization sealing
MFH-5002	Hydrocarbon	500	210	Inert Gas	Low-viscosity applications

4. Data Reliability | Test Authority & Verification

All performance data cited in this document represents objective measurement results obtained from accredited, government-affiliated testing institutes in the Republic of Korea, as listed below.

Institute	Full Name	Test Items	Reference
KITECH	Korea Institute of Industrial Technology	TGA & Helium Leak Test	https://eng.kitech.re.kr
KOPTRI	Korea Polymer Testing & Research Institute	Vapor Pressure (OECD TG 104, Effusion method) — Report No. 25-09458	https://www.polymer.co.kr/eng/

5. Target Applications

MAGRON MFF-M Grade PFPE Ferrofluid is the only product line in the world to simultaneously deliver three core performance attributes — approximately 100°C higher heat resistance, vapor pressure at the parts-per-trillion level, and a helium leak rate below 1×10^{-11} Torr·L/s — embodying differentiated technological value held exclusively by MAGRON.

► Key Target Applications

- **Semiconductor:** Vacuum sealing in corrosive active-gas environments such as Etch, CVD, PVD, and ALD processes.
- **Display & LED:** Rotary-shaft vacuum sealing for OLED deposition equipment and MOCVD systems.
- **Vacuum Robotics:** Rotary shafts and manipulators of vacuum robots in ultra-high-vacuum (UHV) environments.
- **Scientific Instruments:** Analytical instruments (SEM, TEM, XPS, etc.) and accelerator / synchrotron radiation facilities.
- **Inert-Gas Vacuum:** Inert-gas environments such as sputtering and ion implantation.
- **Aerospace, Nuclear & Defense:** Aerospace, nuclear, and defense equipment applications.

Company Information

MAGRON CO., LTD.

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Address: #403, 3-dong, Gyeonggi Technopark, 705 Hae-an-ro, Sangnok-gu, Ansan-si, Gyeonggi-do, 15588, Republic of Korea

Country: Republic of Korea

Industry: Manufacturing of Ferrofluid & Magnetic Fluid Sealing Products

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