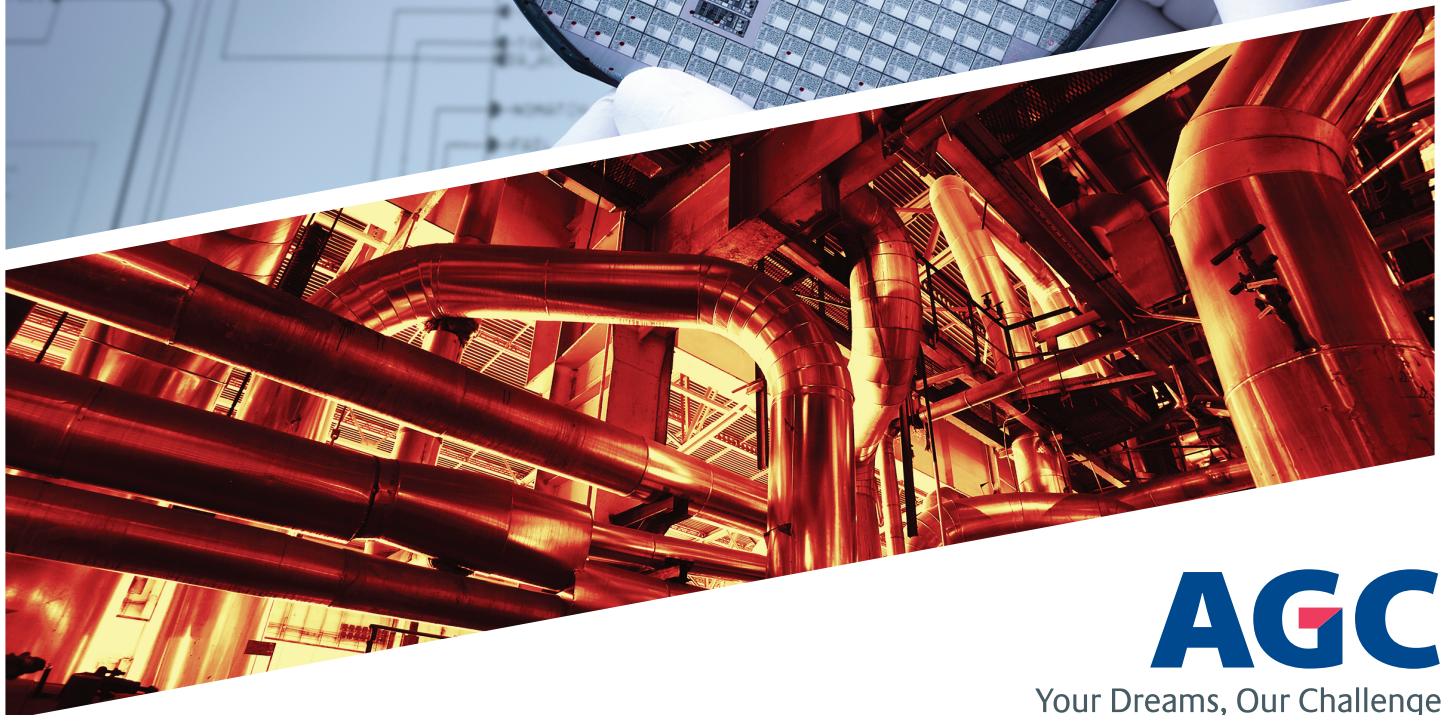
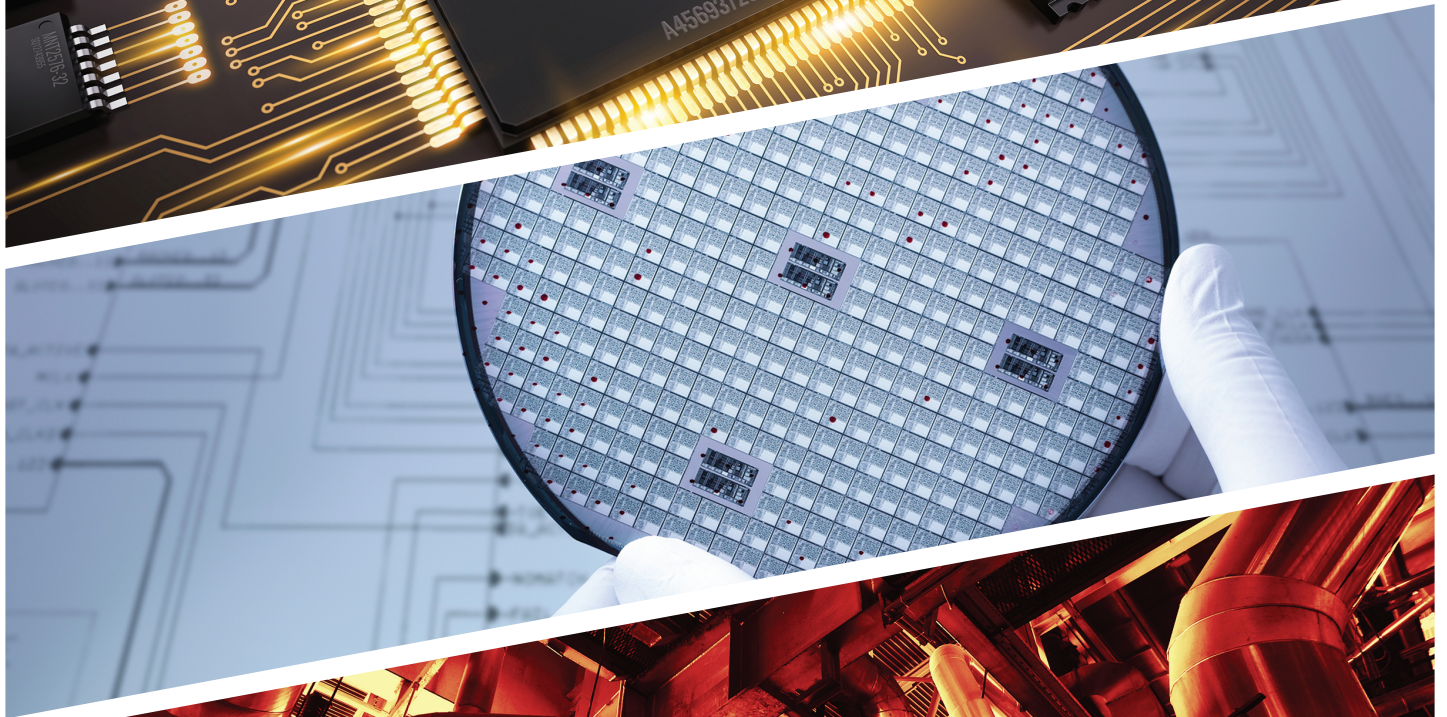
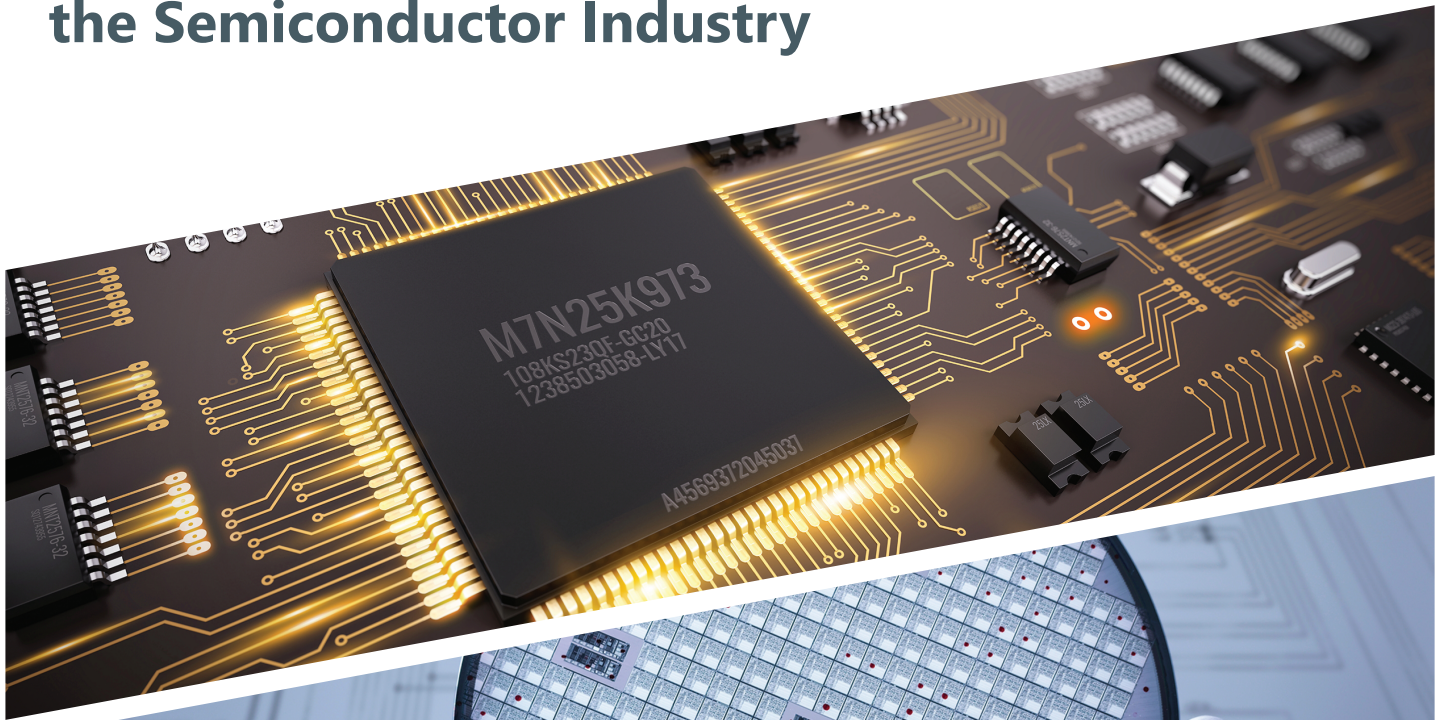




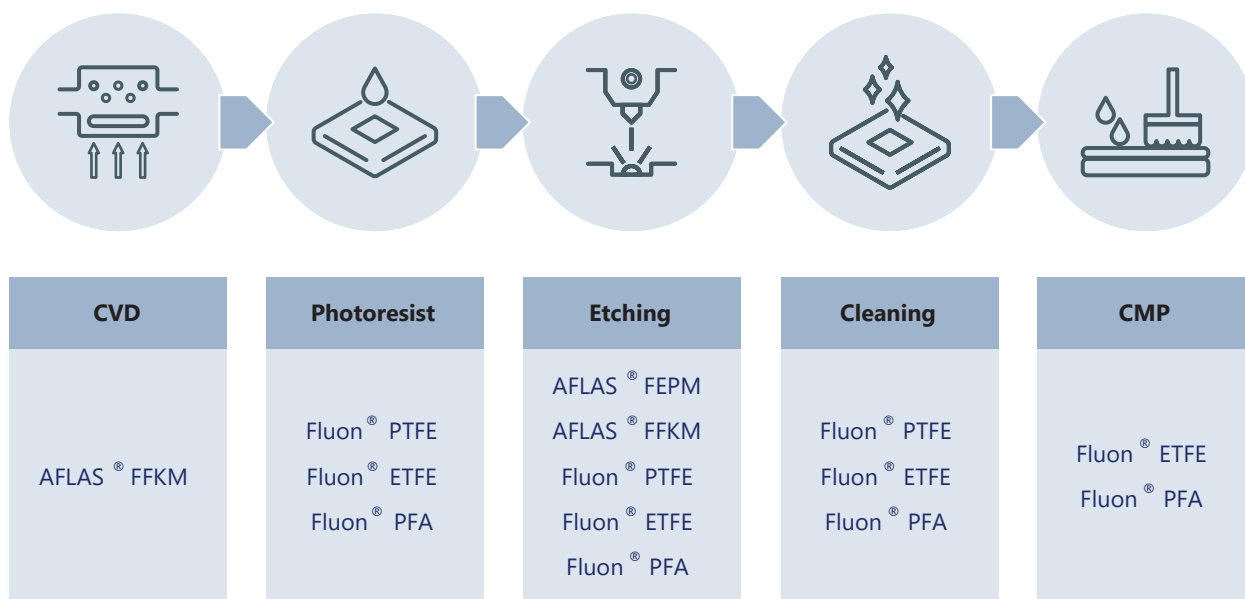
## High Functional Fluoropolymers for the Semiconductor Industry



**AGC**

Your Dreams, Our Challenge

## Fluoropolymers in the Semiconductor Manufacturing Process



## High-Performance Sealing Materials

AGC's AFLAS<sup>®</sup> FFKM series offers the ultimate in long-lasting sealing performance under the harshest of conditions. Its peroxide-curable grades are capable of continuous operation at 250°C and the nitrile-curable options push that beyond 300°C, and with low compression set, a seal made from AFLAS<sup>®</sup> FFKM will keep going for a long time.

AFLAS<sup>®</sup> FFKM is available with naturally high hardness, requiring no fillers, which means fewer impurities that would otherwise cause problems in the manufacture of semiconductor components due to interactions with aggressive chemicals. The absence of fillers also ensures the best resistance to plasma generation during the etching process.

| Grade   | Service Temperature (°C) | Compression Set* (%) | Storage Modulus (kPa) | Peroxide | Nitrile | Chemical Ind. | Oil and Gas | Semiconductor | Plasma | Comments                             |
|---------|--------------------------|----------------------|-----------------------|----------|---------|---------------|-------------|---------------|--------|--------------------------------------|
| PM-3000 | 250                      | 14.3                 | 480                   | •        |         | •             | •           | •             |        | Versatile; good compression set      |
| PM-3500 | 250                      | 22                   | 450 - 820             | •        |         |               |             | •             | •      | High hardness with no filler         |
| PM-5000 | 300                      | 12                   | 200 - 500             |          | •       |               |             | •             | •      | Low sticking force; improved cool CS |
| PM-5500 | 300                      | 11                   | 250 - 550             |          | •       | •             | •           | •             | •      | High hardness with no filler         |

\* O-ring (JIS B 2401, P-26) specimen ID: 25mm, OD: 31mm; compression 25%; peroxide grades 70h @ 200°C, nitrile grades 70h @ 250°C

| Plasma                                  | Gas flow (sccm) | Mass Change (%) |         |         |
|-----------------------------------------|-----------------|-----------------|---------|---------|
|                                         |                 | PM-3500         | PM-5000 | PM-5500 |
| O <sub>2</sub>                          | 30              | 4.7             | 0.2     | 4.3     |
| CF <sub>4</sub> /O <sub>2</sub>         | 20/30           | 4.1             |         |         |
| NF <sub>4</sub> /N <sub>2</sub> (20:80) | 30              |                 | 6.8     | 8.6     |

300W, ambient temperature, 1.5 h



## Fluoropolymers for Everything-Resistant Parts

For more than fifty years, the Fluon® range of fluoropolymers has provided a high level of performance in terms of chemical resistance and stability across a wide temperature range, with PTFE and PFA capable of surviving conditions from cryogenic to 260°C, and ETFE exhibiting mechanical toughness under high vibration at temperatures high and low.

The unique combination of properties makes fluoropolymers excellent choices for a multitude of components and parts throughout the semiconductor wet and fabrication processes.



|                                  | PTFE | PFA  | ETFE | PVDF | FEP  | PP   |
|----------------------------------|------|------|------|------|------|------|
| Maximum service temperature (°C) | 260  | 260  | 150+ | 150  | 200  | 90   |
| Electrical properties            | ●    | ●    | ●    | ▲    | ●    | ●    |
| Dielectric constant (23°C, 1MHz) | 2.1  | 2.1  | 2.6  | 8.4  | 2.1  | 2.1  |
| Mechanical properties            | ▲    | ▲    | ●    | ●    | ▲    | ▲    |
| Chemical properties              | ●●   | ●●   | ●●   | ▲    | ●●   | ▲    |
| Processability                   | ▲    | ●    | ●●   | ●●   | ●    | ●●   |
| Specific Gravity                 | 2.17 | 2.15 | 1.73 | 1.76 | 2.14 | 0.92 |

Fluon® ETFE and PFA grades are suitable for injection moulding or extrusion and offer very low metals and impurity content, low enough to meet the requirements of **SEMI F57**.

Fluon® ETFE offers greater mechanical performance compared to PFA, making it ideal for intricate injection moulded parts such as valve caps, and its chemical performance gives it advantages over traditional PVDF components in critical fluid handling applications.

|          | Melting Point (°C) | Melt Flow Rate (g/10min) | Tensile Strength (MPa) | Elongation (%) | Comments                                                              |
|----------|--------------------|--------------------------|------------------------|----------------|-----------------------------------------------------------------------|
| C-88AXP  | 260                | 9 - 12                   | 48                     | 415            | Good all round grade with enhanced stress crack resistance            |
| C-88AXMP | 260                | 26 - 43                  | 42                     | 430            | Fast extrusion grade, suitable for injection moulding intricate parts |
| P-63P    | 305 - 315          | 7 - 18                   | 32                     | 410            | Ideal for automated injection moulding processing                     |

Fluon® ETFE is also available in powder grades for rotolining. This allows vessels to be coated with a chemically resistant layer with no seams or other weak points.

The most common grade, **Fluon® TL-581**, is specifically designed to resist stress cracking and achieves a **UL94 rating of V-0**.

|          | Melting Point (°C) | Melt Flow Rate (g/10min) | Particle size (µm) | Application thickness (mm) | Comments                                      |
|----------|--------------------|--------------------------|--------------------|----------------------------|-----------------------------------------------|
| TL - 581 | 260                | ~ 20                     | 250 - 300          | 2 - 5                      | Rotolining grade for seamless coatings vessel |

## Fluon+™ ETFE Cross Linkable Compounds

Significant reductions in the risk of fire propagation through semiconductor fabrication can be achieved by using metal exhaust systems coated with corrosion and fire resistant linings. Factory Mutual (FM) was founded to approve a safer coating for duct linings.

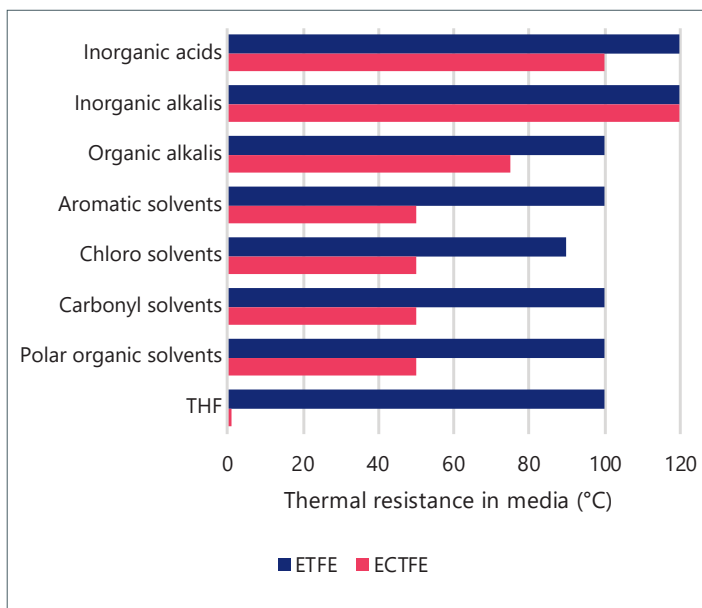
Fluoropolymers are resistant to fire under normal conditions because of the strong carbon-fluorine bonding, and Fluon® ETFE is no different. Flammability tests on layers down to 0.38mm thickness showed that ETFE achieves a flame rating of V-0.

It is for this reason that Fluon® ETFE is available in a powder form suitable for electrostatic coating. Furthermore, these products are already established in systems that have achieved FM 4922 certification. They can be used individually or in combination with each other.

| Grade       | Particle Size (µm) | Application Thickness (µm) |
|-------------|--------------------|----------------------------|
| TL - 081    | 80 - 150           | ≤ 800                      |
| CP - 801XGN | 50 - 150           | ≤ 800                      |

Fluon® ETFE is as capable in most chemical environments as ECTFE, and better in many.

It is also resistant to ozone, which is often used to clean ductwork since it kills microbes, dust mites and bacteria.



Maximum recommended temperature in media (°C)

|       | Initial (%) | After Exposure (%) | Retention (%) |
|-------|-------------|--------------------|---------------|
| ETFE  | 582         | 580                | 99            |
| ECTFE | 530         | 257                | 49            |

Change in Elongation to Break  
Compression moulded sheet (130 x 130 x 1 mm)  
Ozone (10%vol)/ flow = 0.042m<sup>3</sup>per hr / 20°C / 32 Days

# AGC

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