



# Fluon+™ MODIFIERS - Functionalised PTFE

Superior Additives for Enhanced Surface Chemistry

AGC Chemicals is a leading fluoropolymer manufacturer and the world's no. 1 in ETFE production. The European subsidiary, AGC Chemicals Europe, produces Fluon® PTFE and ETFE and markets other fluorinated products, including Fluon® PFA and AFLAS® Fluoroelastomers. The product range offers excellent resistance against heat, chemicals and corrosion, and has a broad base of applications in industrial, automotive, aerospace, oil and gas, and other markets where long-lasting high performance is necessary.

## Fluon+™ Functionalised PTFE – Superior Additives for Enhanced Surface Chemistry

AGC's Fluon+™ functionalised PTFE products are a range of additives specially designed to be compatible with high-performance thermoplastics, and therefore capable of withstanding very high service temperatures. This helps to enhance the performance of the base resin or matrix without losing the main properties of the matrix material.

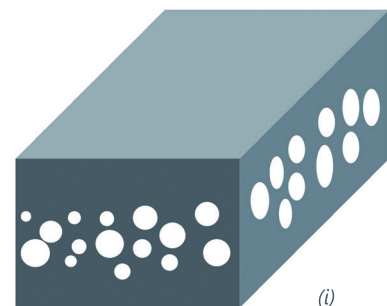
PTFE is widely regarded in industry for its excellent surface properties, such as its water repellence, which is a result of its low surface energy. The same property affords the low-friction performance of PTFE, giving it an advantage in areas where movement with minimum resistance are beneficial, such as bearings.

However, PTFE cannot be used in such situations alone. Its mechanical properties are too weak to stand up to the rigour of repetitive, high-impact work. For this reason, a stronger matrix material is preferred, with a dose of PTFE added. This practice is common already, with grades such as AGC's Fluon® PTFE Micropowders being added to other thermoplastics in order to reduce friction in parts, and to provide enhanced wear resistance.

PTFE can be difficult to blend due to low surface energy, which can be overcome by the superior compatibility of Fluon+™ Functionalised PTFE grades. In common matrix materials, this allows more uniform particle distribution.

### Benefits:

- Greatly reduced run-in time
- Improved dimensional stability
- Enhanced mechanical toughness



(i)



(ii)

*Graphic interpretation of how PTFE (white spheroids) can blend with other thermoplastics (grey body) when (i) non-functionalised, or (ii) functionalised. (i) shows restricted distribution of PTFE particles and no surface interaction. (ii) shows more uniform distribution and immediate presence of PTFE at the material surface.*

Analysis by Scanning Electron Microscope and Energy Dispersive X-ray shows how the PTFE (highlighted in orange) is distributed throughout a number of composite material samples.

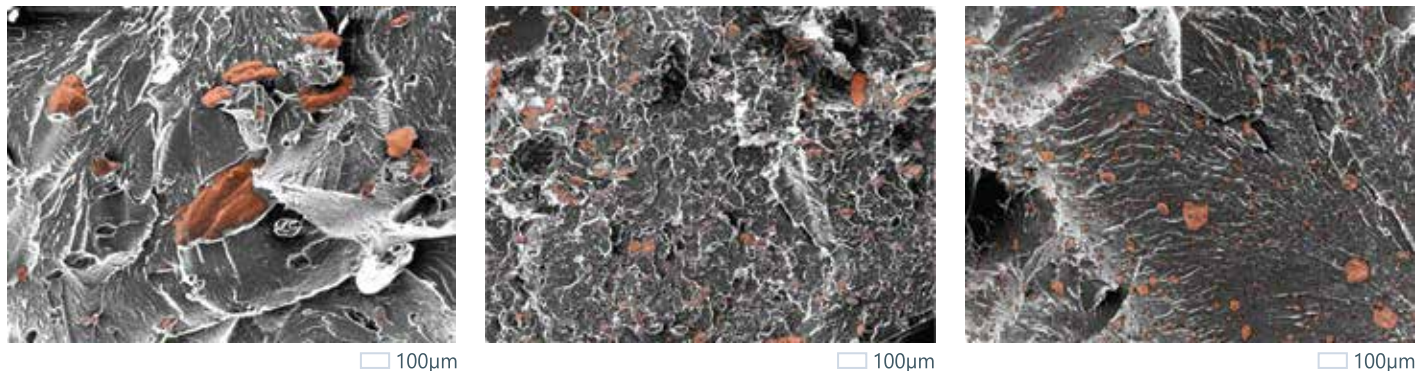


Image 1 – PPA with non-functionalised PTFE, uneven distribution

Images 2 and 3 – PPA with different blends of functionalised PTFE showing much more uniform distribution

## Grade Guide

AGC offers a variety of grades for specific applications, depending on the base resin, in two main categories:

- Fluon+™ FL2900 series for low acid and moderate fine particle distribution
- Fluon+™ FL2600 series for enhanced fine particle distribution and low shear compounding

Base resin melting point	< 240 °C	240 to 300 °C	> 300 °C
Example compatible resins	POM, PA6, PA12	PA66, PPS	PEEK, PPA
Fluon+™ FL2900 series grades	FL2922Z	FL2912Z	FL2902Z
Fluon+™ FL2600 series grades	FL2622Z	FL2612Z	FL2602Z

## Impact on Physical Properties

Using Fluon+™ Functionalised PTFE in a PPA composite can reduce the abrasion loss by around 70% when compared to a non-functionalised PTFE additive, while also reducing friction by around 30%. The functionalisation of the PTFE has no measurable impact on the mechanical properties of the composite material, while also massively improving the surface smoothness. Fluon+™ Functionalised PTFE therefore offers advantages in durability, consistency and performance over traditional PTFE micropowders.

PPA + additive	Abrasion loss (cm <sup>3</sup> )	Dynamic friction coefficient	Tensile strength (MPa)	Elongation at break (%)	Tensile modulus (MPa)	Surface roughness (µm)
Fluon® PTFE (standard)	0.0085	0.38	58	16.9	549	0.6137
Fluon+™ PTFE FL2602Z	0.0025	0.29	67	18.4	639	0.0293
Fluon+™ PTFE FL2604Z*	0.0022	0.23	59	16.0	568	0.0484

Table 1 – physical properties of PPA-PTFE blends

\* Variations on the above grades can be made available on discussion

AGC Chemicals Europe, Ltd.

Hillhouse International, Fleetwood Road North  
Thornton-Cleveleys, FY5 4QD, UK