AGC Chemicals

Fluon® ETFE FILM

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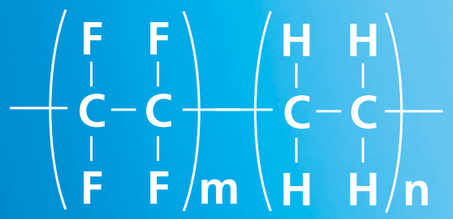
High-performance fluoropolymer film manufactured from Fluon® ETFE resin

Fluon® ETFE FILM is high-performance film from AGC (Asahi Glass Co., Ltd.), a global leading fluorochemicals company.
Films of thickness between 12μm and 500μm are manufactured from AGC's own Fluon® ETFE resin
(ethylene tetrafluoroethylene copolymer) using a plasticiser-free, unique film-forming method.
Properties of the film are those typical of fluoropolymers; excellent heat resistance, chemical resistance,
long-term weatherability, transparency, anti-stick properties and electrical properties.
This fluoropolymer film also has good mechanical properties that give both flexiblity and toughness.
Fluon® ETFE FILM is easy to use and provides outstanding performance in a wide range of applications.

■ Fluon®ETFE



7 features of Fluon® ETFE FILM

Heat resistance

Fluon® ETFE FILM meets UL 94 VTM-0 (V-0 for 250μm and above) and is suitable for use within the wide temperature range of -200°C to 200°C (*). It withstands continuous use over 150°C. (*e.g. as release film for printed circuit boards)

Chemical resistance

Fluon® ETFE FILM is highly resistant to the majority of chemicals and solvents.

Weatherability

Fluon® ETFE FILM is resistant to wide light wavelength from infrared to ultraviolet and is suitable for long-term outdoor use. Film subjected to a 16,000 hour accelerated weathering test (comparable to over 30 years' exposure) shows almost no signs of deterioration.

Light Transmittance

The total light transmittance of Fluon® ETFE FILM is about 95%,making it ideal for use as a protective film for solar cells, greenhouses, roofing and architectural facades.

Anti-stick properties

Fluon® ETFE FILM possesses excellent anti-stick and antifouling characteristics, as well as excellent release properties.

Mechanical properties

Fluon® ETFE FILM has good flexibility and its tensile elongation is over 400% at room temperature and over 600% at 100°C. It is suitable for tracking the shape of many types of mould cavities even if the form is highly complex.

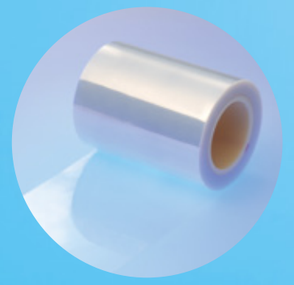
Electrical properties

Fluon® ETFE FILM exhibits high dielectric strength even in its thinnest form. It has a low dielectric constant and low dielectric loss tangent over a wide frequency range.

Thin but Versatile

AGC (Asahi Glass Co., Ltd.), a long-standing company with great experience in the chemical industry, developed Fluon® ETFE FILM in 1975.
Since then, Fluon® ETFE FILM has opened up many new doors leading to the development of epoch-making products and new technologies.
There is a whole new world waiting to be discovered thanks to multi-functional Fluon® ETFE FILM.

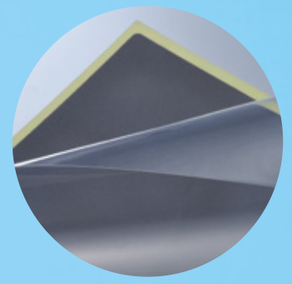
Fluon® ETFE FILM



1972
AGC started developing Fluon® ETFE resin

1975
Fluon® ETFE FILM was launched

1985
F-CLEAN™ film for greenhouses was launched



1989
Fluon® ETFE FILM was used in electronics

1997
Fluon® ETFE FILM was implemented in photovoltaic protection

2004
Fluon® ETFE FILM was applied to the Allianz Arena (Munich, Germany)

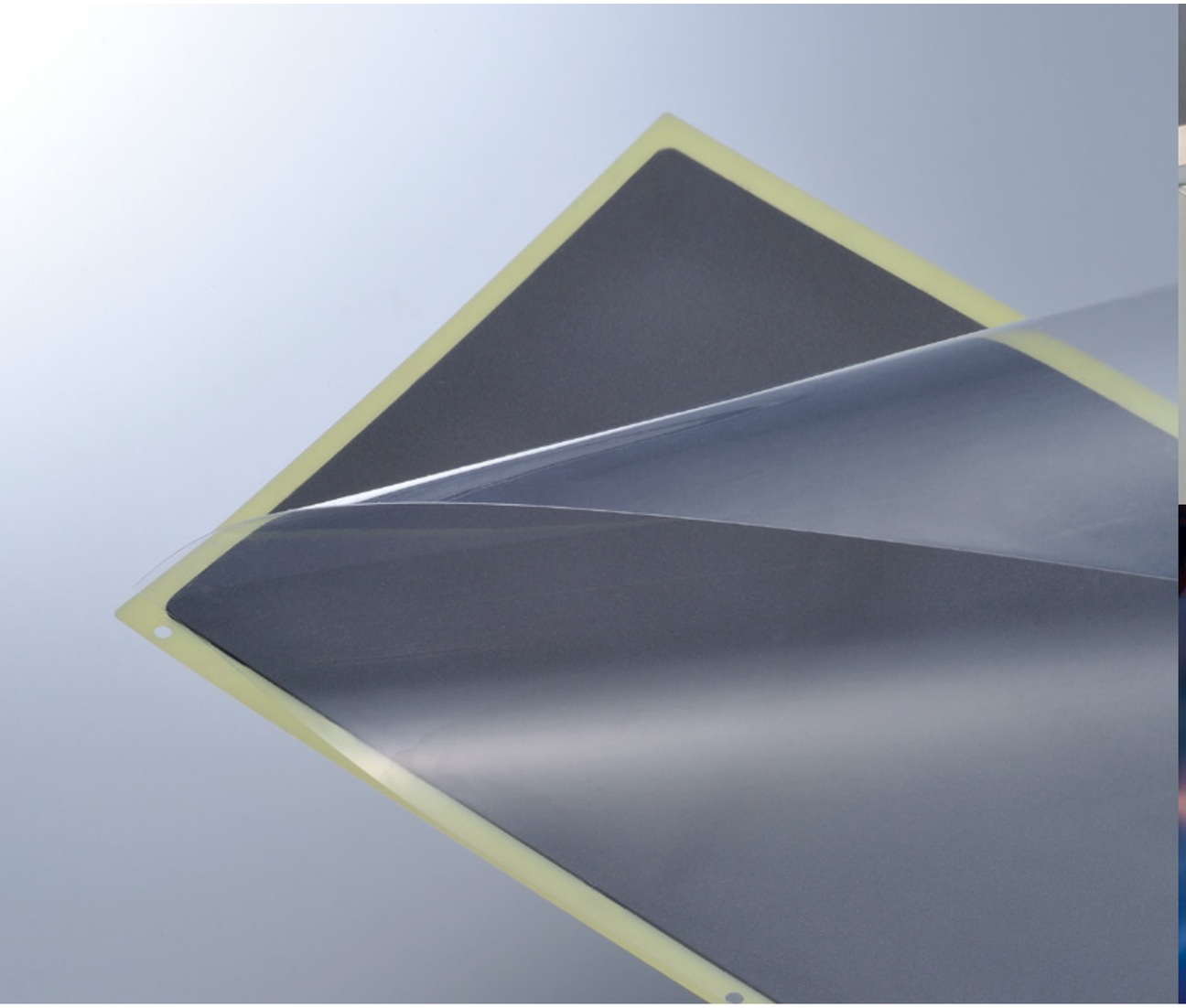
Next Stage

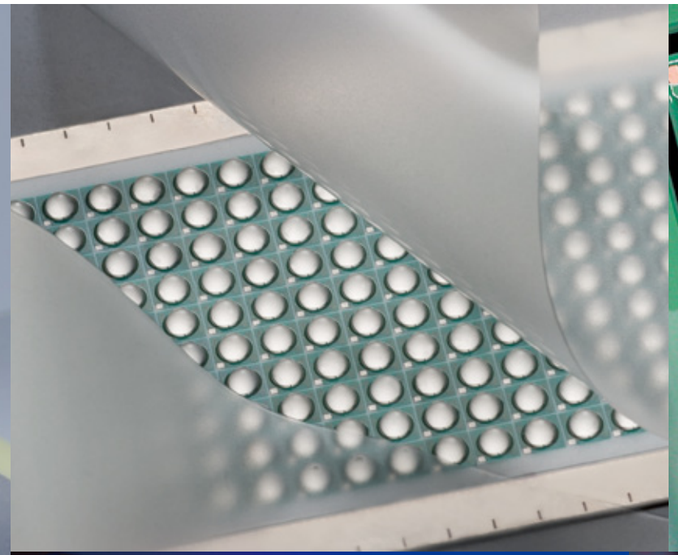
Working Together in the Development of Electronics

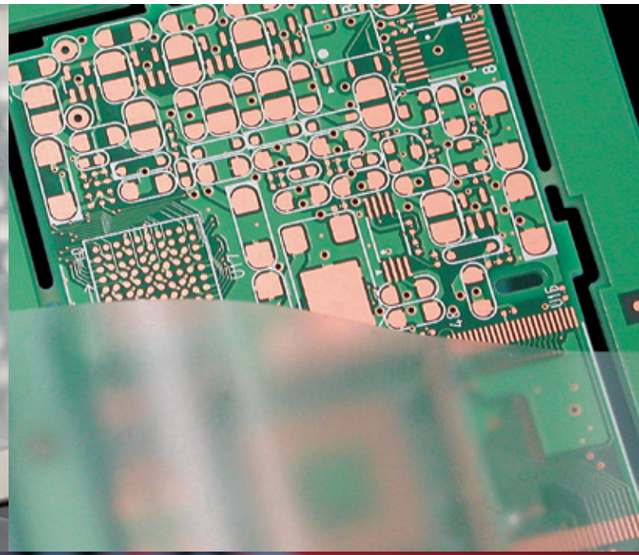
ETFE Film offers outstanding heat resistance, anti-stick properties and flexibility, all of which are ideal properties for use in electronic devices.

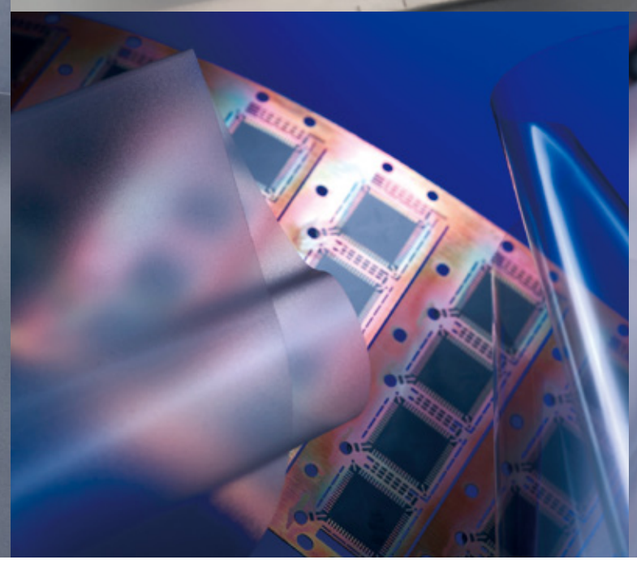
The features of Fluon® ETFE FILM, such as anti-stick properties, inherent flexibility and heat resistance at 200°C (392°F), make it suitable for use in applications such as release film in semiconductor manufacturing and printed circuit boards. The use of ETFE film ensures no contamination of electronic products or machinery, thanks to the fact that it does not contain any plasticisers or additives.

■**Features of Importance in this application**







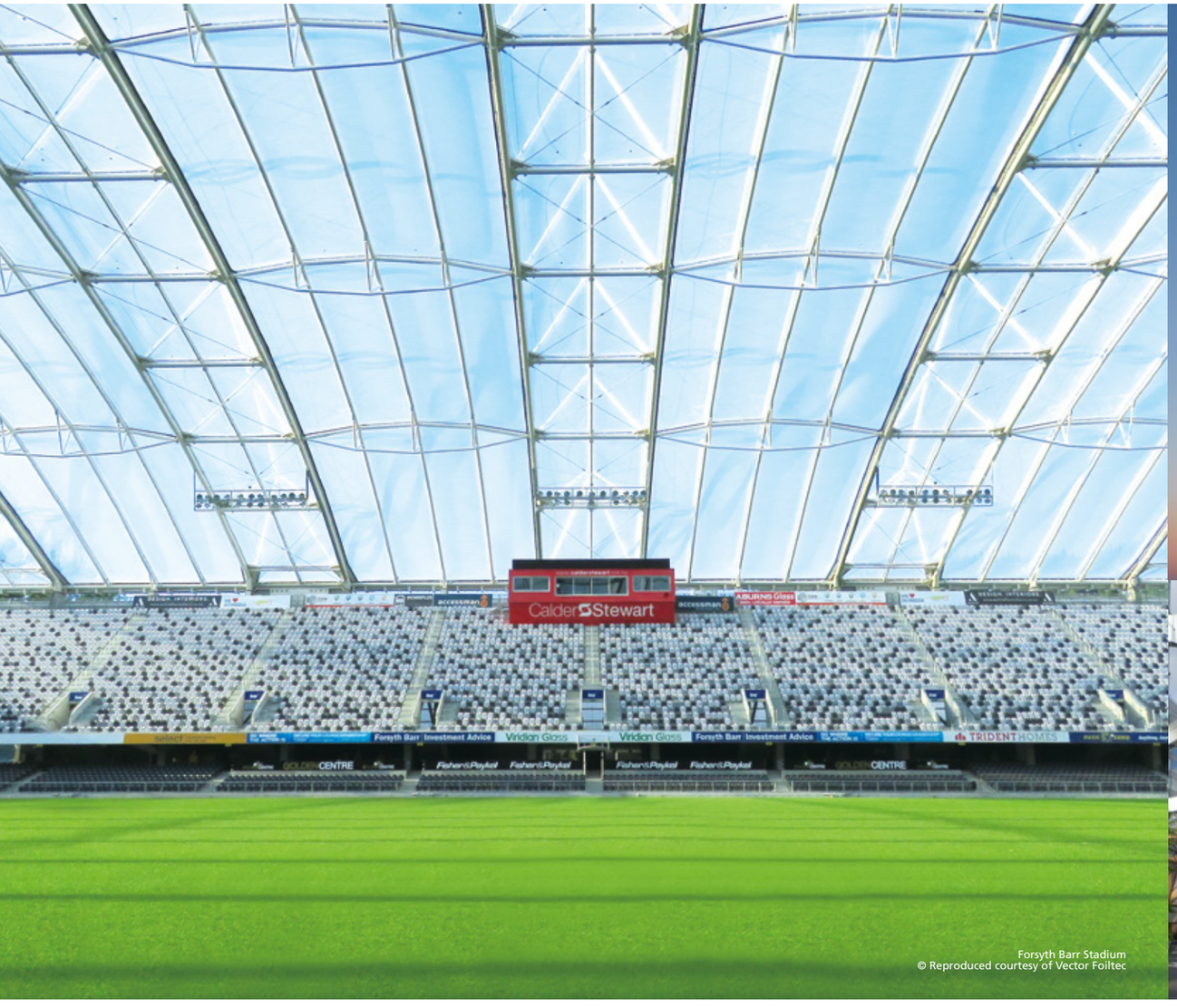


Fluon® ETFE FILM brightens up your city

Fluon® ETFE FILM makes indoor spaces brighter and more comfortable. It is ideal for designers to use in membrane structures thanks to its flexible properties and modern look.

Fluon® ETFE FILM is an ideal material providing a solution to architects that offers strong physical properties, weatherability and dirt resistance. When using Fluon® design ideas are unlimited with the flexibility, lightweight characteristics and high transparency of the material. Domes and other shapes can be obtained, illumination is possible and extenisve areas can be covered.Many iconic public and commercial buildings and sports stadia around the world are made with ETFE film. Due to the high transparency (including UV) natural turf and a wide variety of plants grow well under Fluon® ETFE FILM.

■Features of Importance in this application



Forsyth Barr Stadium
© Reproduced courtesy of Vector Foiltec

Allianz Arena,Munich Fabricator: Seele Cover GmbH

Canary Wharf Crossrail Station Fabricator: Seele Cover GmbH

Khan Shatyr Entertainment Center
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Innovation in Greenhouse Horticulture

A strong and transparent film that brings the sunshine inside, opening up new possibilities for greenhouses.

F-CLEAN™ is of a much higher quality than conventional greenhouse coverings.
It has light transmission of up to 94% (grade: 60μm, clear) making the inside of greenhouses almost as bright as in the open fields.
The long-term weather durability of the material (25-30 years) saves project costs and labour costs are also reduced as re-covering is not required.
F-CLEAN™ significantly improves the yield of horticultural greenhouses by optimising their indoor environment.

■Features of Importance in this application

Photo:Construction: 1998 / Location: Aichi, Japan / Produce: Tomato / Film thickness: 60μm / Photo:2015

F-CLEAN™ is ETFE FILM for greenhouse horticulture which is supplied by AGC GREEN-TECH CO.,Ltd.
Contact for enquiries : AGC GREEN-TECH CO.,Ltd.

The use of Fluon® ETFE FILM has infinite possibilities

Applications are constantly increasing.

Fluon® ETFE FILM goes further than release film in electronics or membrane structures.
Another application example, is Fluon® ETFE FILM as a top coat for wallpaper or furniture, thanks to its excellent anti-stick and antifouling characteristics. It provides an easy-clean surface to which dirt does not stick.
Additionally because of its excellent chemical resistance properties and low impurity elution performance, it is also used as a medical material and as an insulating material.
Fluon® ETFE FILM really is used in a very wide range of applications.

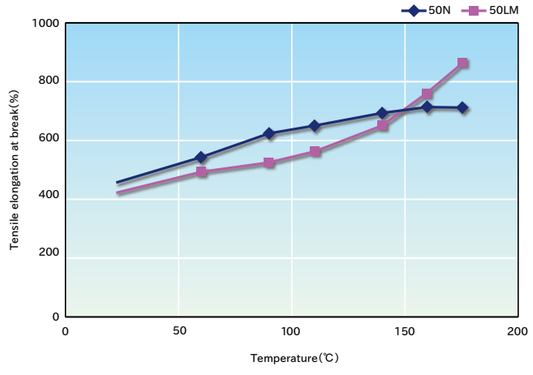
Photo:SUNAGA BUSSAN Co., Ltd. "Clean SOFT"

General properties

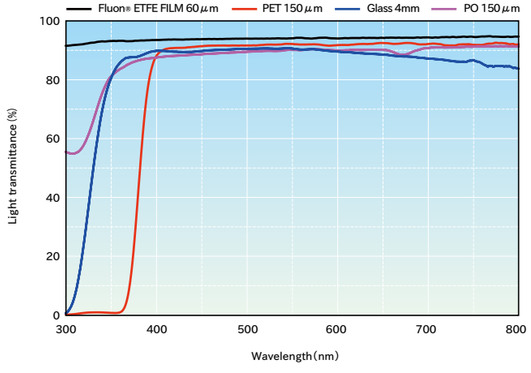
	Item	Unit	Test method	Fluon® ETFE FILM
Physical properties	Specific gravity	-	ASTM D792	1.74-1.76
	Tensile strength at break	MPa	JIS K7127	>39
	Tensile elongation at break	%	JIS K7127	200-510
Thermal properties	Melting point	℃	-	260*1
	Linear thermal expansion coefficient	10^{-5}/℃	ASTM D696	9.4
	Flammability	-	UL	94VTM-0*2
	Thermal resistance	℃	UL746B	150*3
Chemical properties	Water absorption (23℃, 24hr)	%	ASTM D570	0.03
	Chemical resistance	-	ASTM D543	Excellent
	NaOH 10%		60℃, 1week	Excellent
	HCl 35%			
	Xylene			
	Toluene			
	Releasability (Water contact angle)	°	-	100-110
Electrical properties	Volume resistivity	Ω・cm	ASTM D257	10^{17}
	Dielectric constant (23℃, 1MHz)	-	ASTM D150	2.6
	Dielectric tangent	-	ASTM D150	
	60Hz			0.0006
	1KHz			0.0008
	1MHz			0.005
	1GHz			0.01
	Breakdown voltage	kV/0.1mm	ASTM D149	12
	Arc resistance	sec	ASTM D495	120

*1 LM: 225 *2 25-150μm
*3 Continuous retention temperature (tensile strength at break, tensile elongation at break and breakdown voltage are over 50% of initial value after 100,000 hours)

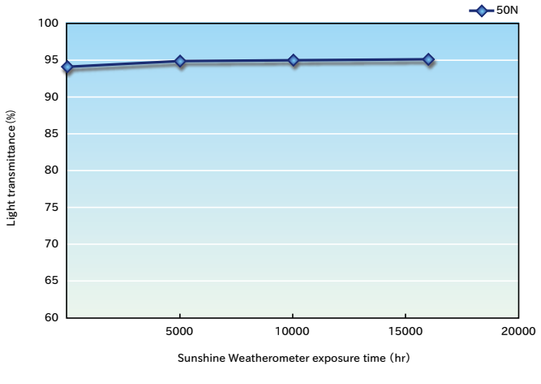
Temperature dependence of tensile elongation at break



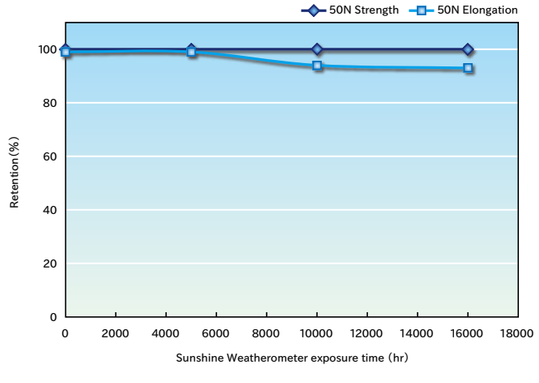
Light transmittance



Change in light transmittance with accelerated weathering test



Change in tensile strength and elongation with accelerated weathering test



Grades

Thickness (μm)	Grade	Width (mm)	Surface treatment	Roll length (m)
12	N	1020	S	2100
25	N	1250	NT	1200
40	N	1250	NT	500
50	N	1250	NT	500
100	N	1250	NT	250
200	NJ	1550/1600	NT/S	250
250	NJ	1550/1600	NT/S	200
250	WT	1550/1600	NT/S	200
250	TB	1550/1600	NT/S	200
300	NJ	1550/1600	NT/S	170
25	MW	1250	NT	1000
50	HK/KN	1600	NT	530
50	MW	1250	NT	530
25	LM	1250	NT	1020
50	LM	1280	NT	515
75	LM	1280	NT	515
50	HL/KL	1250	NT	530

*These are representative grades and sizes. We have many other sizes and colours. Please contact us.

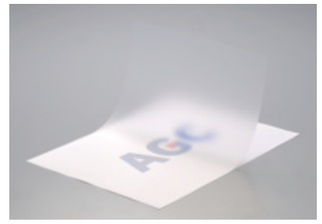
■ Grades
N Natural (clear)
NJ Natural (clear, thick)
MW Double side matte (clear)
HK Matte on outside of the roll (clear)
KN Matte on inside of the roll (clear)
LM Natural (clear, low melting point)
HL Matte on outside of the roll (clear, low melting point)
KL Matte on inside of the roll (clear, low melting point)
WT For membrane structure (white)
TB For membrane structure (blue)

■ Surface treatment
NT No treatment
S Single sided corona treatment
D Double sided corona treatment
CS Special surface treatment

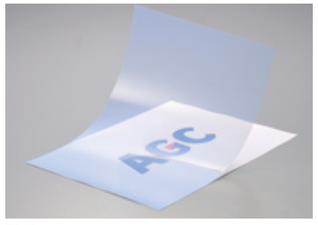
Illustrations of Various Grades

N (Clear)

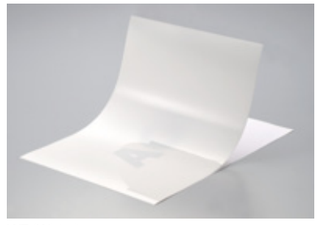
HK/KN (Single side matte, clear)

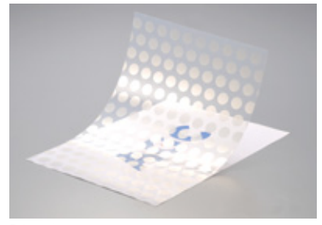


MW (Double side matte, claer)



TB (Blue)


WT (White)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Fluoropolymers as an Environment-Symbiotic Technology

Environmental protection is regarded as the highest priority in every industrial field. Fluoropolymers and fluoroelastomers have been used in environmentally-friendly products and processes. The properties typical of fluoropolymers and fluoroelastomers, such as weatherability, non-flammabilityand chemical resistance, give longer life to various products and save resources and reduce industrial waste. One example is the use of Fluon® ETFE in automotive fuel hose to reduce fuel permeation. Another is F-CLEAN™ ETFE film used as a covering for commercial greenhouses because of its exceptionally long service life. AGC assists with continuous environmental protection efforts, through development, improvement, and enhancing these type of products. AGC, as a manufacturer of fluorine chemicals, continuously strives to establish recycling techniques and anti-pollution process techniques in current production sites, in an effort to reduce the environmental load of fluorine products. AGC believes that fluoropolymer technology offers advantages and more possibilities to contribute to solve environmental issues and plays an important role in realising a safe and comfortable society of an environment-symbiotic type.

AGC GROUP NETWORK for Fluon® ETFE FILM

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2) Please refer to the SDS (Safety Data Sheet) for safety and details.

3) This product is not designed for use in the implantation of the human body or for medical applications that come in contact with body fluid or body tissues, ASAHI GLASS CO., LTD. carries out no test as to the fitness of the product for any medical applications.

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