



F-CLEAN™ ETFE Greenhouse Coverings

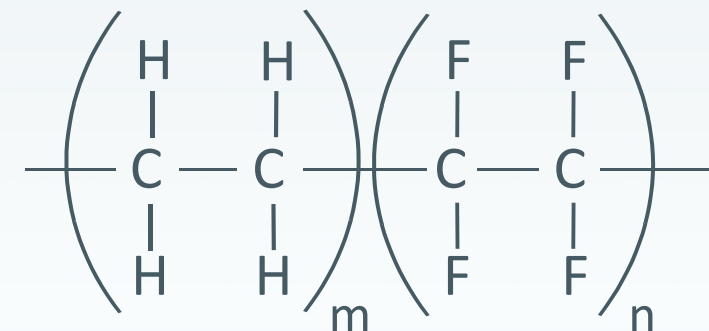
AGC Chemicals Americas, Inc.



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What is F-CLEAN?

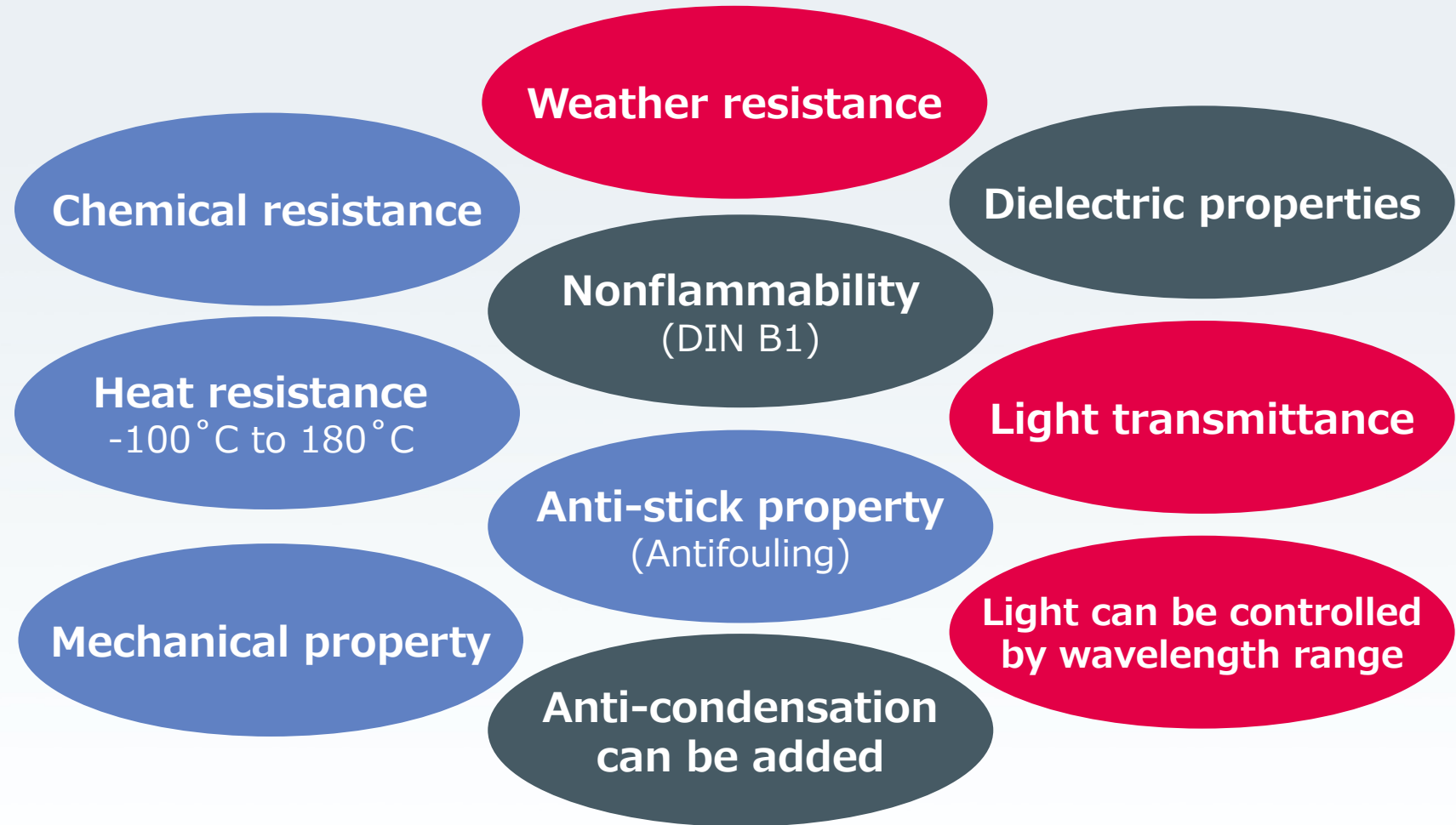
- F-CLEAN is the brand name of AGC's Fluon® ETFE film used for greenhouse coverings.
- Fluon ETFE film is a high-performance film produced using Fluon ETFE resin.
- Fluon ETFE film has excellent features, and is used in many applications.
- AGC produces ETFE resin and film.



Ethylene-Tetrafluoroethylene copolymer

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The Many Advantages of F-CLEAN Coverings



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Other Applications of ETFE Film

BUILDINGS AND STRUCTURES

- Roofs
- Façades

ENERGY

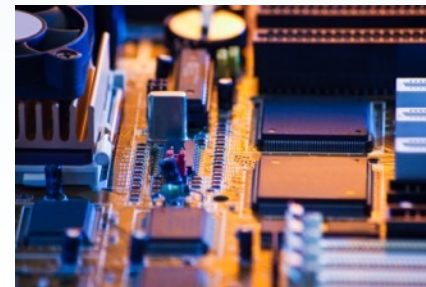
- Solar cell protection
- Battery insulation

ELECTRONICS

- Release film for FPC
- Release film for semiconductors

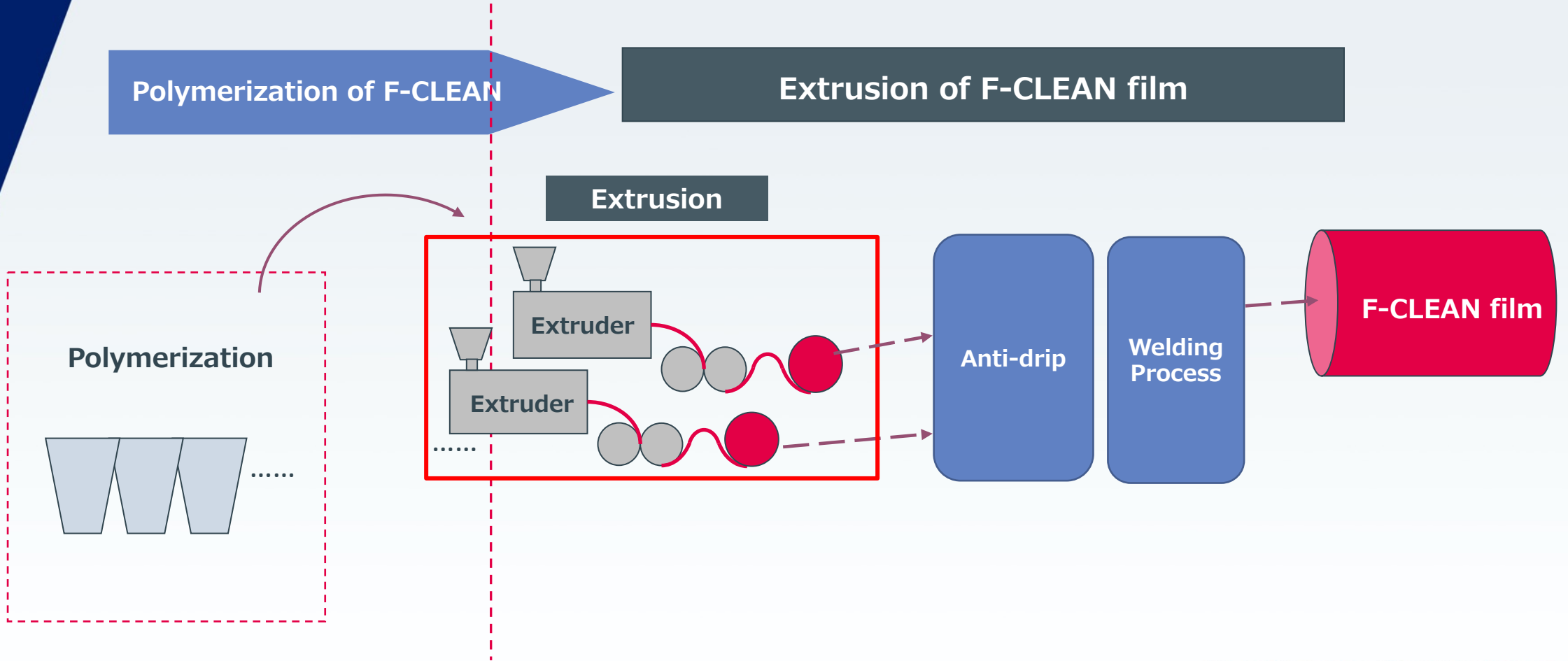
OTHER

- Protective film surfaces
- Wallpaper surfaces
- Thermo molded parts



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Producing F-CLEAN Films



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Benefits of F-CLEAN Greenhouse Coverings

- Easy cleaning
- Long life and durability
- Fire safety
- More light than glass
- Low reflection and refraction rate
- Improved crop quality

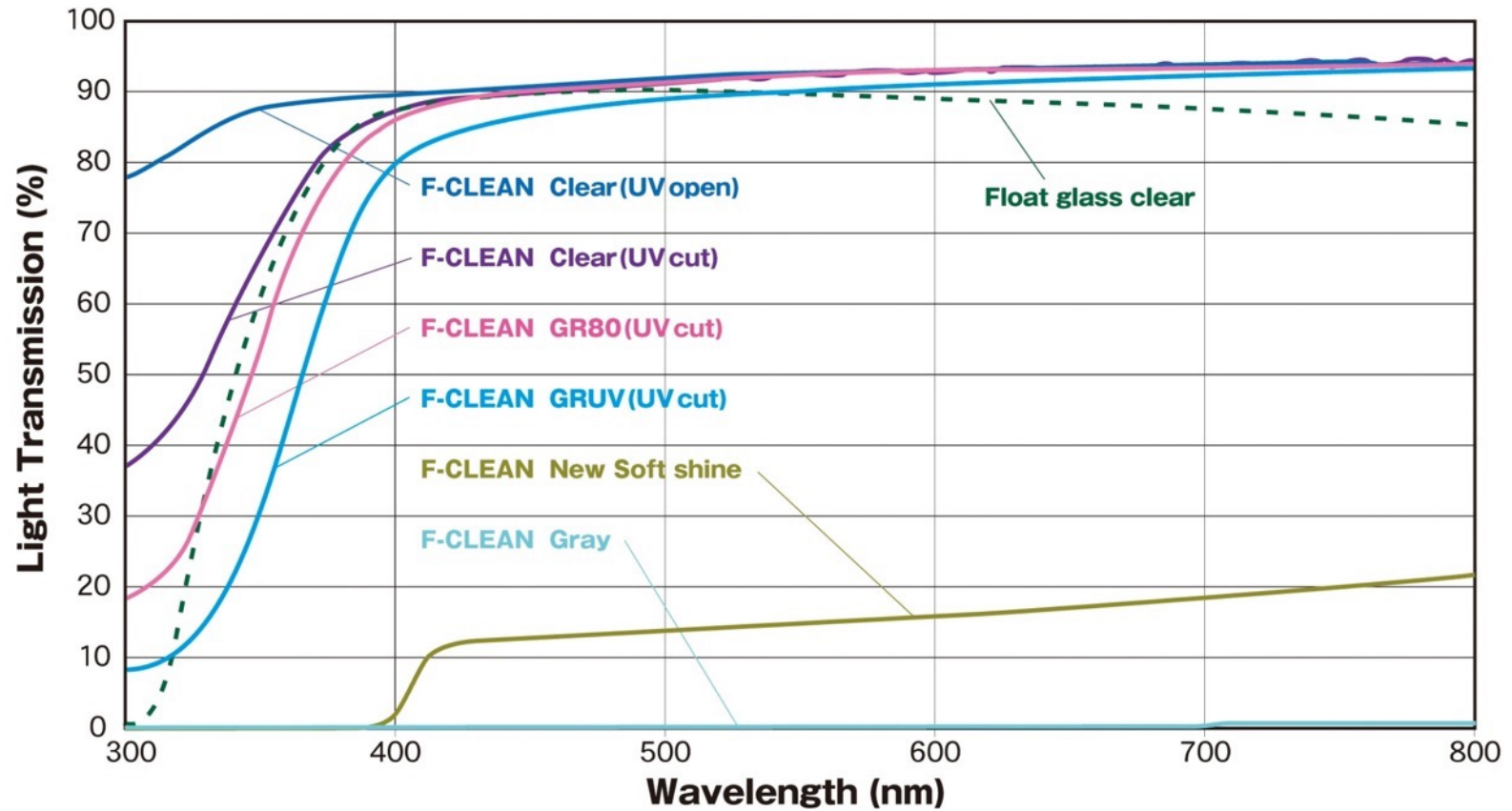
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F-CLEAN Greenhouse Film Options

- Clear – UV open
- Light-diffusing
- Anti-dripping
- UV blocking – UV cutting
- Light blocking – soft shine
- Thickness variations

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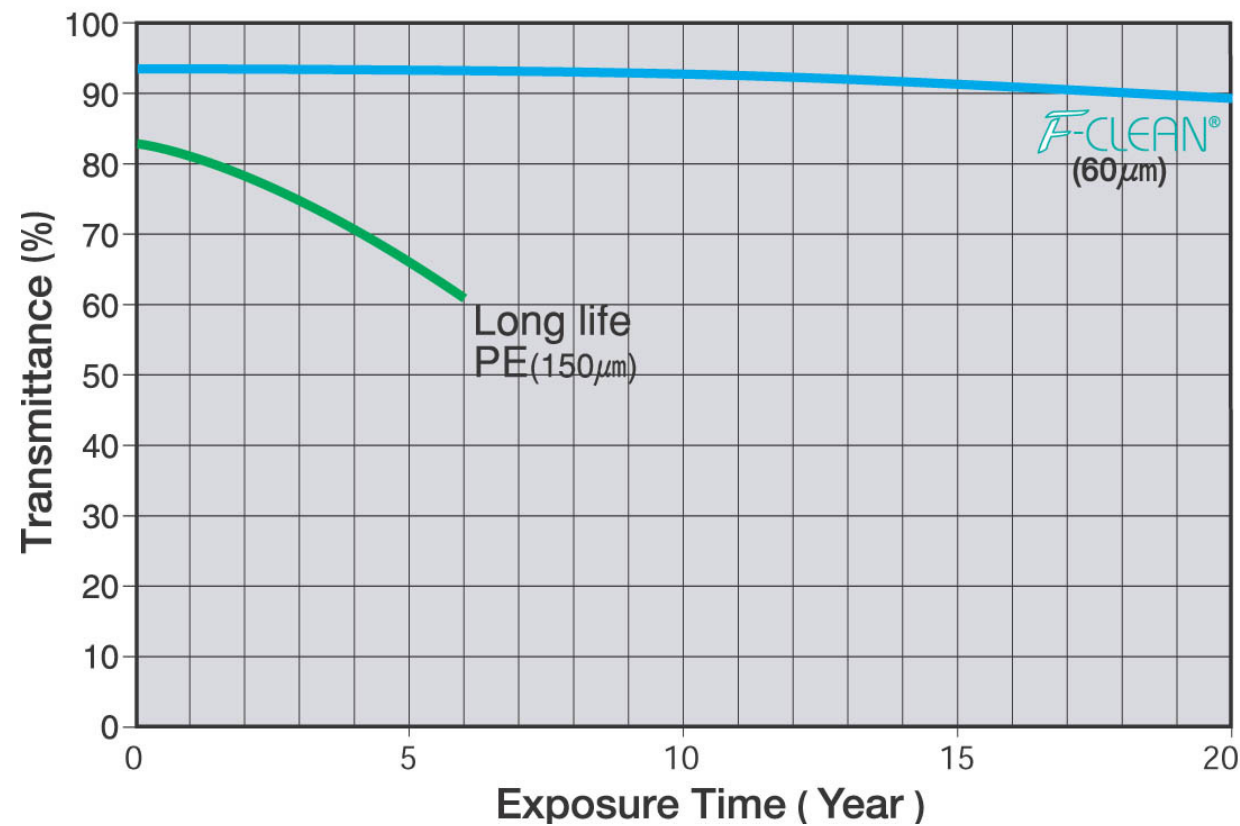
Light Transmittance of F-CLEAN*



*60 micron is 94%. Light transmission is measured according to JIS standard.

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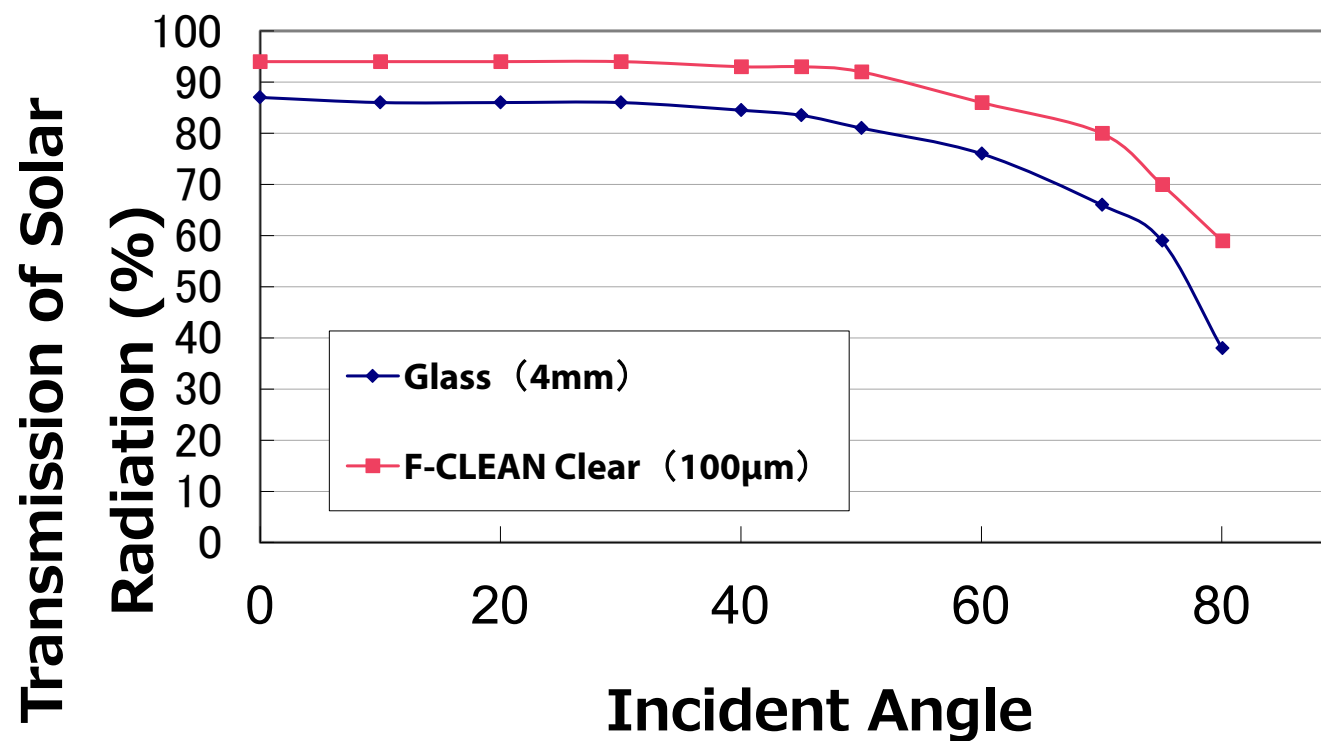
Aging of Light Transmittance



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Low Reflection



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F-CLEAN's Mechanical Properties

	AGC	AT Plastics	Ginegar	Hyplast	Plastika Kritis	Visqueen
Film Name	F-CLEAN	Dura 3	Sunsaver	HYTILUX	Sunmaster	Luminance
Thickness	100 µm	150 µm	200 µm	200 µm	150 µm	150 µm
Tensile Strength at Break	58 MPa	25.6 MPa	21.2 MPa	23 MPa	22 MPa	--
Elmendorf Tear Strength	21 N	7.5 N	--	--	--	--
Elongation at Break	400%	658%	-	550%	500%	--

F-CLEAN's Mechanical Properties



Cutting the film, which is under constant air pressure.



It does not expand further.

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Service Life Over 30 Years



**Greenhouse in Aichi installed in 1988,
photographed in 2009.**



**Greenhouse in Kyushu installed in 1988,
photographed in 2008.**

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F-CLEAN Diffused vs. Clear

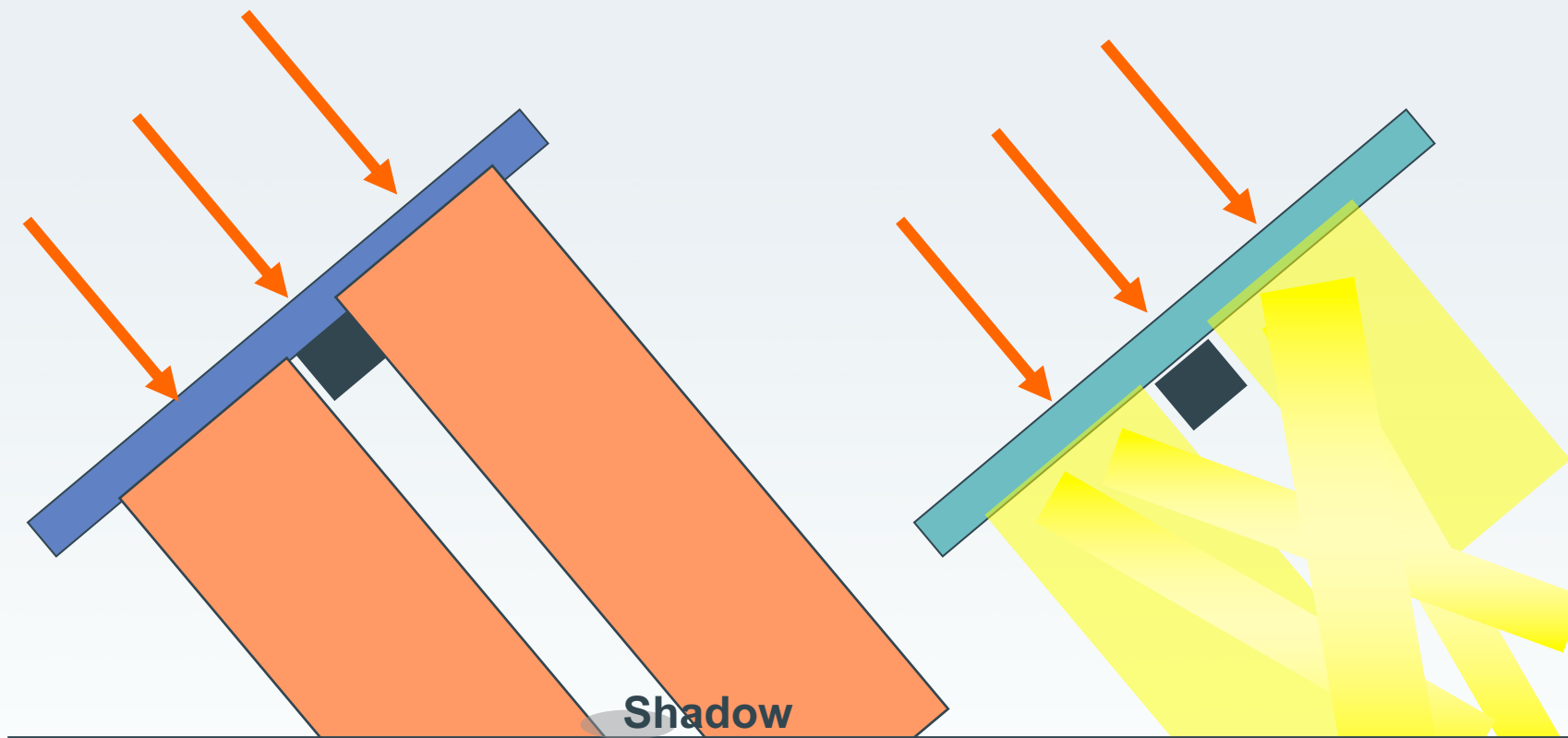


F-CLEAN Diffused



F-CLEAN Clear

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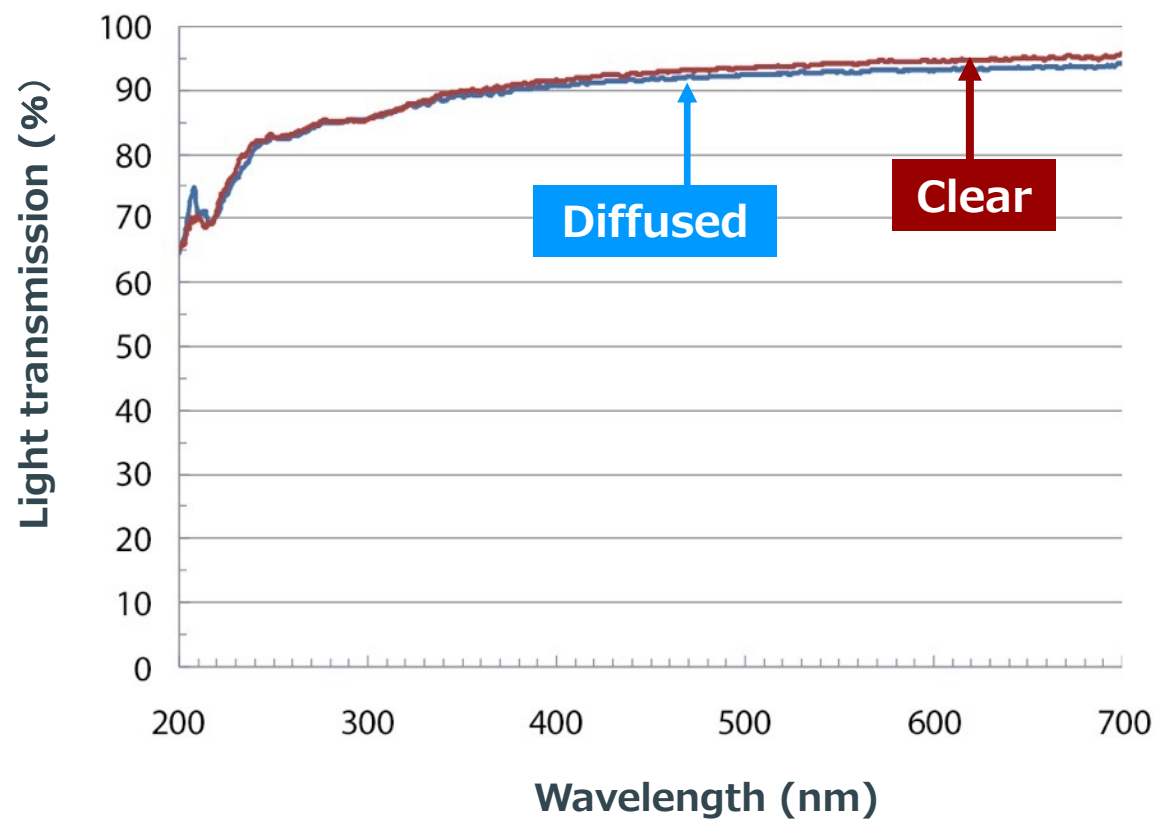


F-CLEAN Clear

**F-CLEAN
Diffused**

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F-CLEAN Diffused



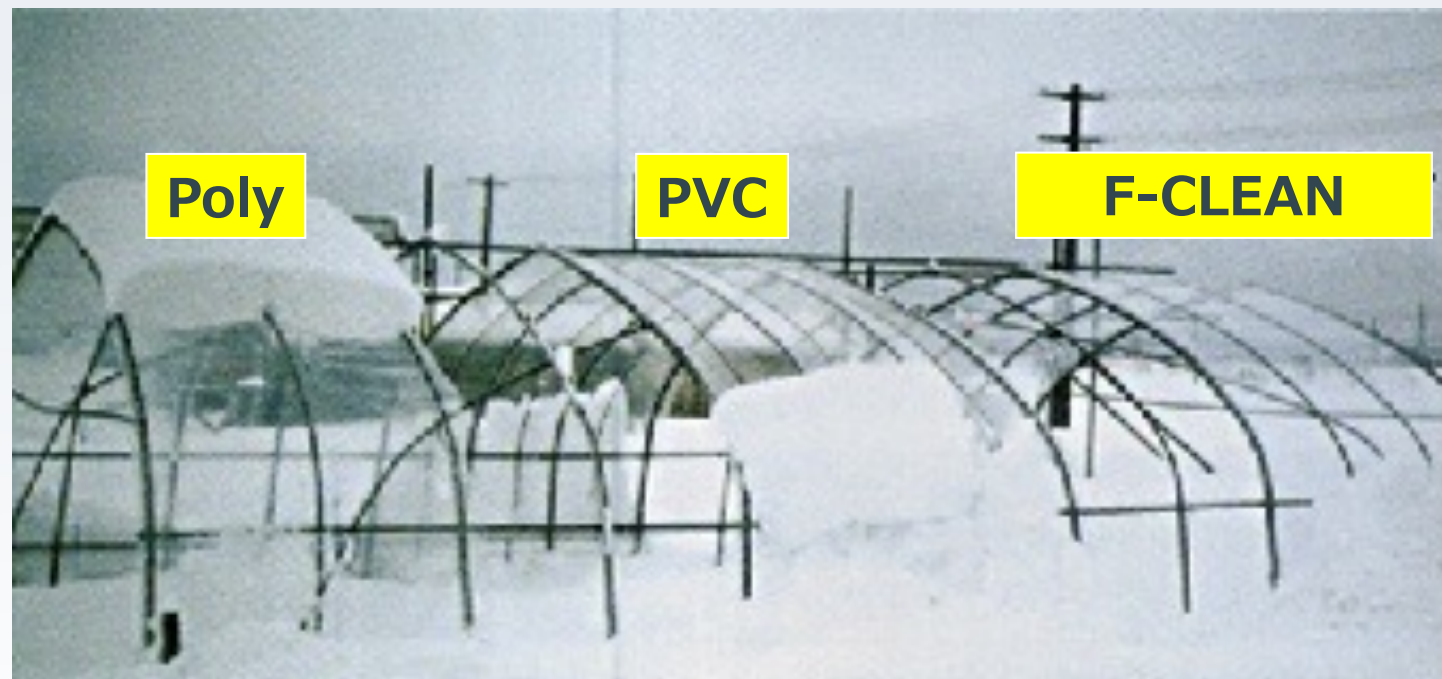
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Non-Stick Properties

Poly

PVC

F-CLEAN



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Chemical Resistance

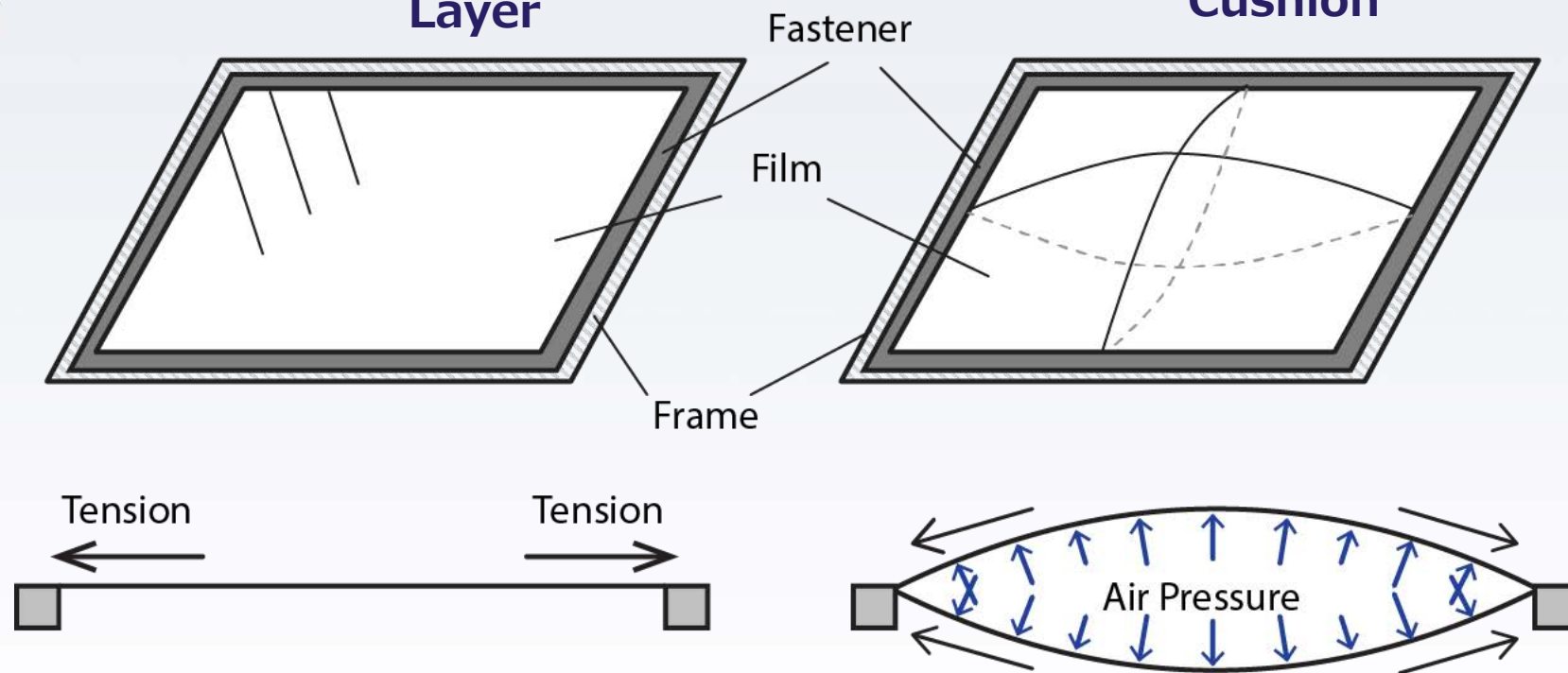
Chemical		Temp. (°C)	Days	Retention (%)	
				Elong.	Wt. Gain
Conc. hydrochloric acid	35%	100	10	100	0.0
Sulfuric acid	78%	121	10	100	0.1
	98%	121	10	100	0.0
Nitric acid	25%	100	14	100	-
	60%	120	10	100	0.7
	70%	60	60	100	-
Sodium hydroxide	10%	120	10	97	0
	50%	120	10	100	-0.3
Ammonium hydroxide	15%	66	7	98	0.1
Chlorine		90	10	94	-
Water		100	7	100	0

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Installation Type

Single Layer

Multilayer Cushion



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Application Photos



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F-CLEAN
Roof bar distance is 2 m

Glass
Roof bar distance is 1 m

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Fukuoko, Japan

Crop: Tomato

Area: 85.000 m²

Installed: 2008

Grade: 100 micron/GR 80

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Miyagi, Japan

Crop: Paprika

Area: 50.000 m²

Installed: 2010

Grade: 100 mic/Clear + 60/Diffused (double layer)



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Germany

Crop: Lettuce

Area: 15.000 m²

Installed: 2006

Grade: 100 mic/Clear



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United Kingdom

Crop: Lettuce

Area: 28.000 m²

Installed: 2007

Grade: 100 mic/Clear



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The Netherlands

Crop: Potted flowers

Area: 10.000 m²

Installed: 2005

Grade: 100 mic/Clear



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Germany

Crop: Potted flowers

Area: 12.000 m²

Installed: 2006

Grade: 100 mic/Clear + 60 Diffused (double layer)



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Italy

Crop: Roses

Area: 4.000 m²

Installed: 2001

Grade: 100 mic/Clear



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Australia

Crop: Tomatoes

Area: 5.000 m²

Installed: 2003

Grade: 100 mic/Clear



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Korea

Crop: Paprika

Area: 100.000 m²

Installed: 1999

Grade: 80 mic/Clear with UV block

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USA

Crop: Potted flowers

Area: 100.000 m²

Installed: 2003

Grade: 100 mic/Clear

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China

Crop: Potted flowers

Area: 10.000 m²

Installed: 2010

Grade: 100 mic/Clear+60/Diffused

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Russia

Crop: Cucumber

Area: 200.000 m²

Installed: 2011

Grade: 100 mic/Diffused



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Taiwan

Crop: Strawberries

Area: 1.600 m²

Installed: 2014

Grade: 100 mic/Diffused (UV Block)



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Taiwan

Crop: Orchid

Area: 10.000 m²

Installed: 2014

Grade: 80 mic/GR80



Taiwan

Crop: Orchid

Area: 10.000 m²

Installed: 2014

Grade: 80 mic/Diffused (UV block)



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Japan

Crop: Fish

Area: 5.000 m²

Installed: 2012

Grade: 100 mic/Gray



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Japan

Crop: Shrimp

Area: 2.300 m²

Installed: 2012

Grade: 100 mic/Gray



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Japan

Crop: Mushrooms

Area: 2.000 m²

Installed: 2012

Grade: 100 mic/Gray



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Japan

Milking cows

Area: 1.000 m²

Installed: 2012

Grade: 100 mic/Soft-shine

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Japan

Food waste compost

Area: 5.000 m²

Installed: 2012

Grade: 100 mic/Clear

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So Why Use F-CLEAN Films?

- Self-cleaning
- Long life and durability
- Fire safety
- Lets in more light than glass
- Low reflection and refraction rate
- Improved crop quality and yield

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AGC

For More Information:



Learn more

www.agcchem.com

610-423-4300 800-424-7833

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