

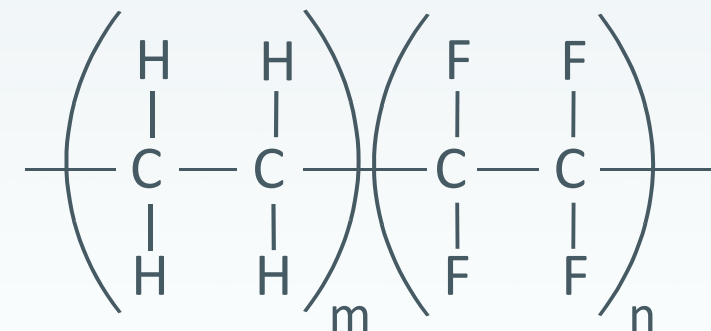
F-CLEAN™

ETFE Greenhouse Coverings

Your Dreams, Our Challenge

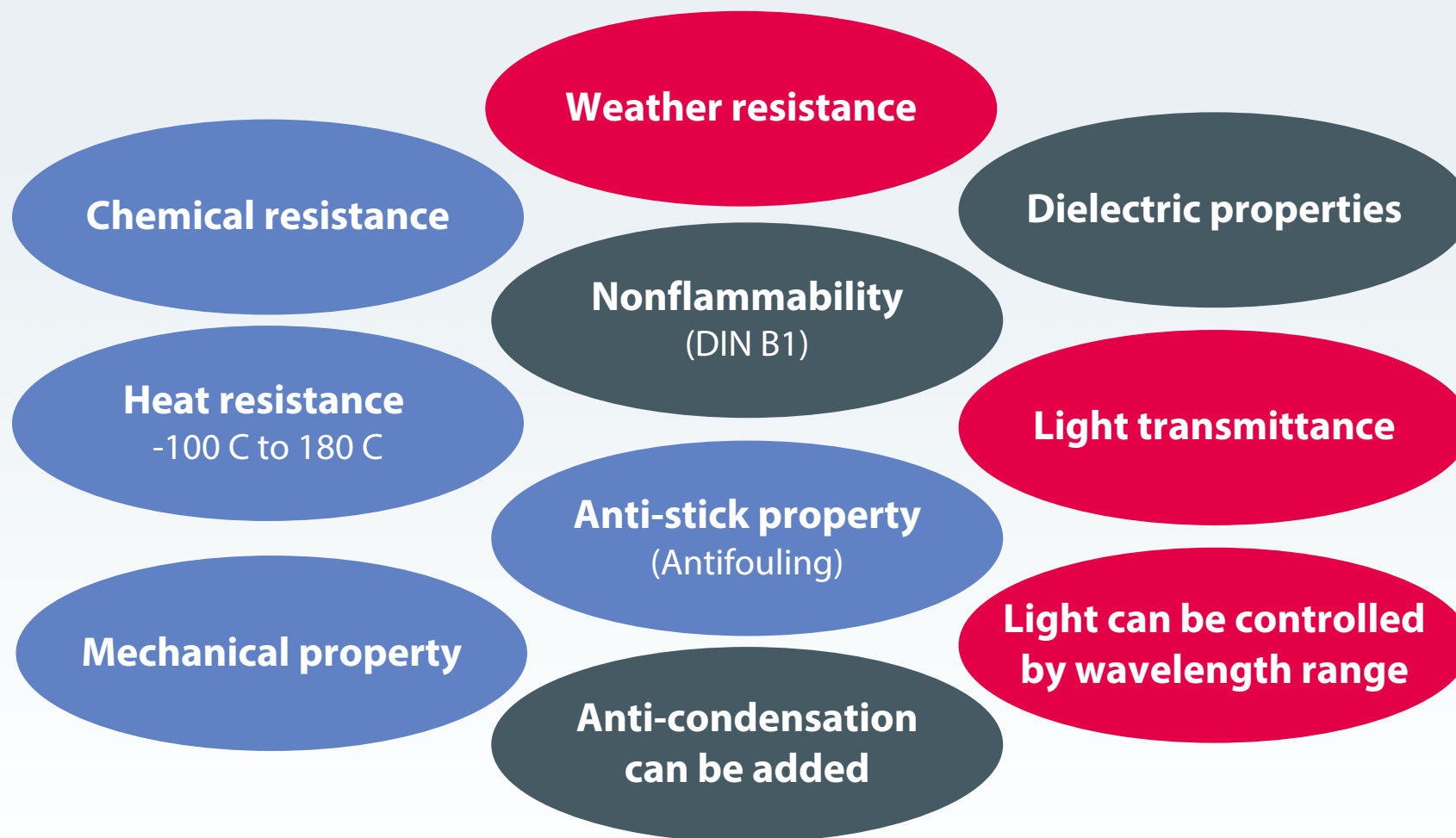
What is F-CLEAN?

- 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

The Many Advantages of F-CLEAN Coverings



Other Applications of ETFE Film

BUILDINGS AND STRUCTURES

- Roofs
- Façades

ENERGY

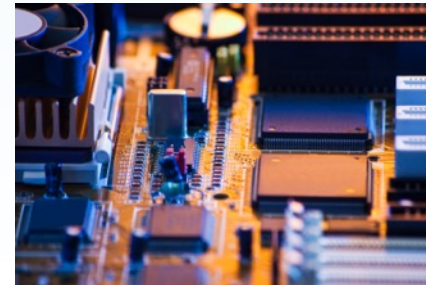
- Solar cell protection
- Battery insulation

ELECTRONICS

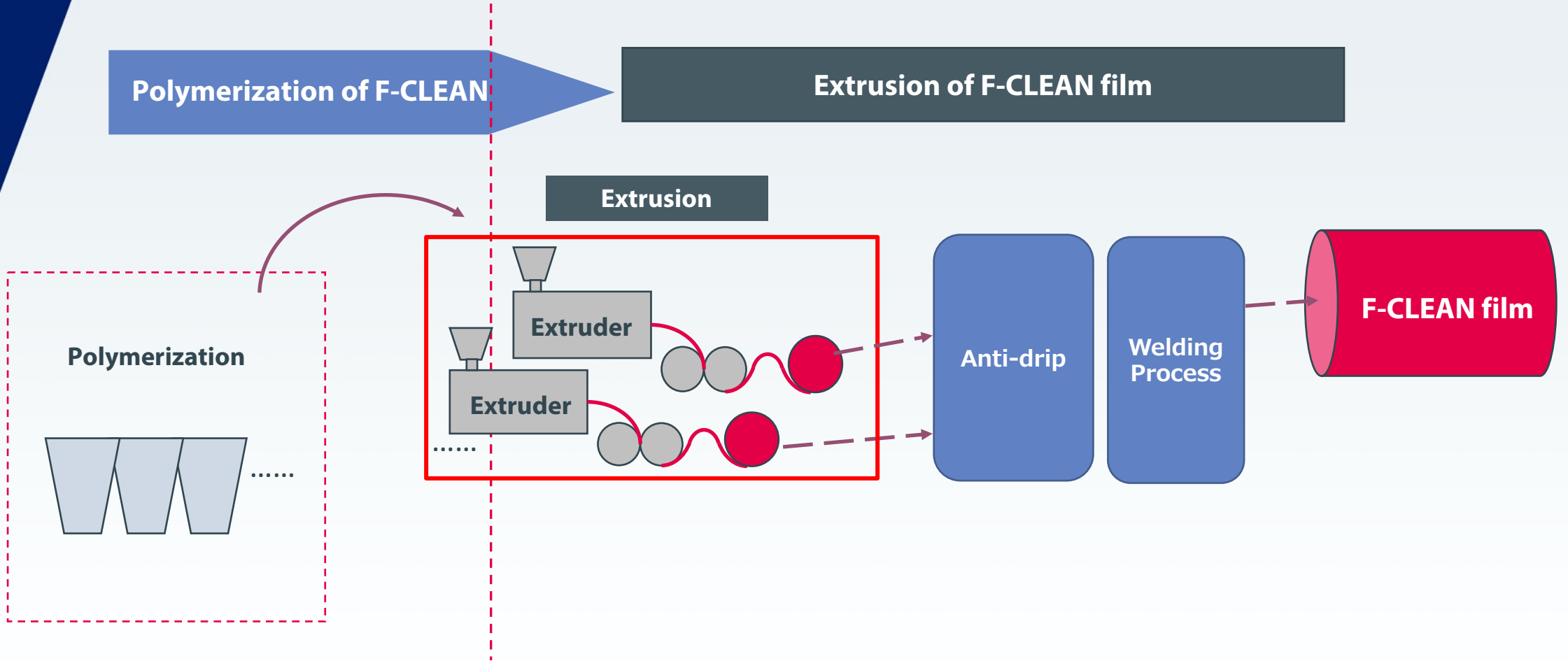
- Release film for FPC
- Release film for semiconductors

OTHER

- Protective film surfaces
- Wallpaper surfaces
- Thermo molded parts



Producing F-CLEAN Films





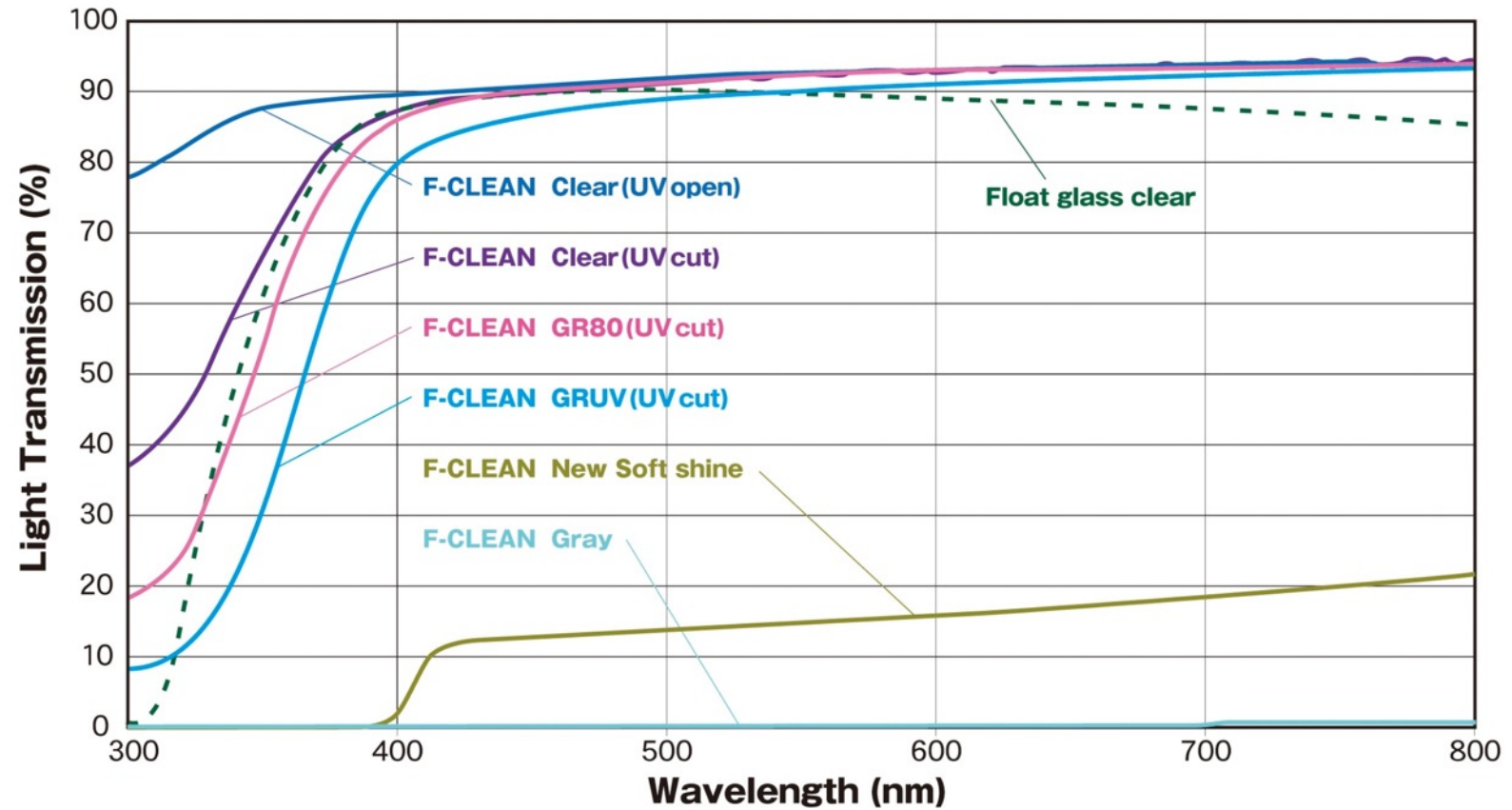
Benefits of F-CLEAN Greenhouse Coverings

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

F-CLEAN Greenhouse Film Options

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

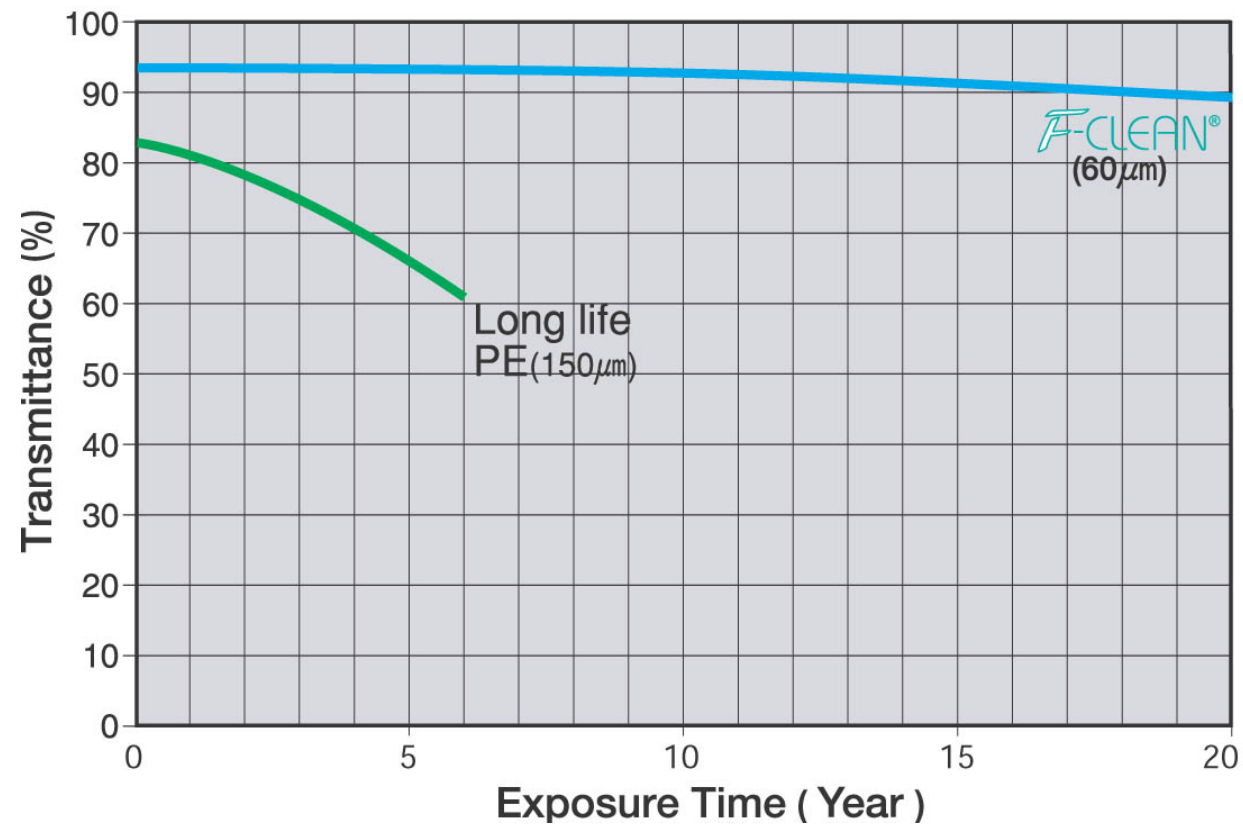
Light Transmittance of F-CLEAN*



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

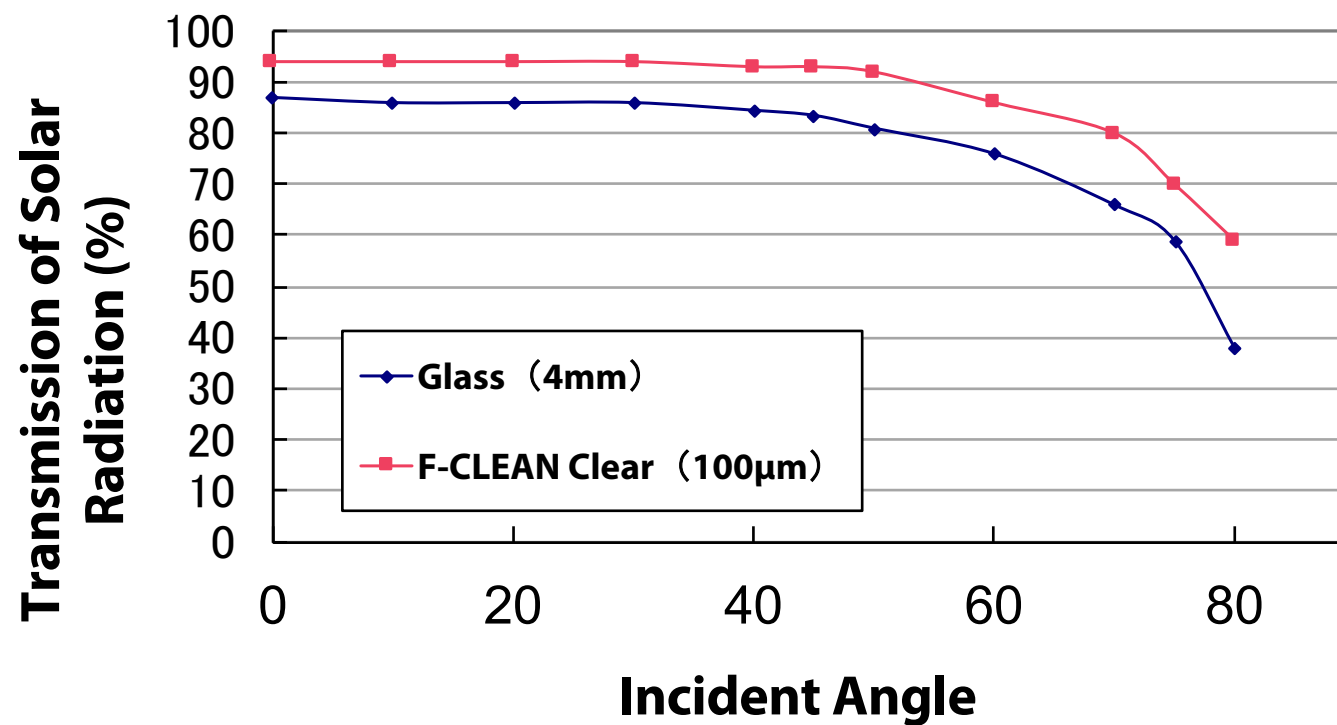
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Aging of Light Transmittance





Low Reflection



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.

Service Life Over 30 Years



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



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

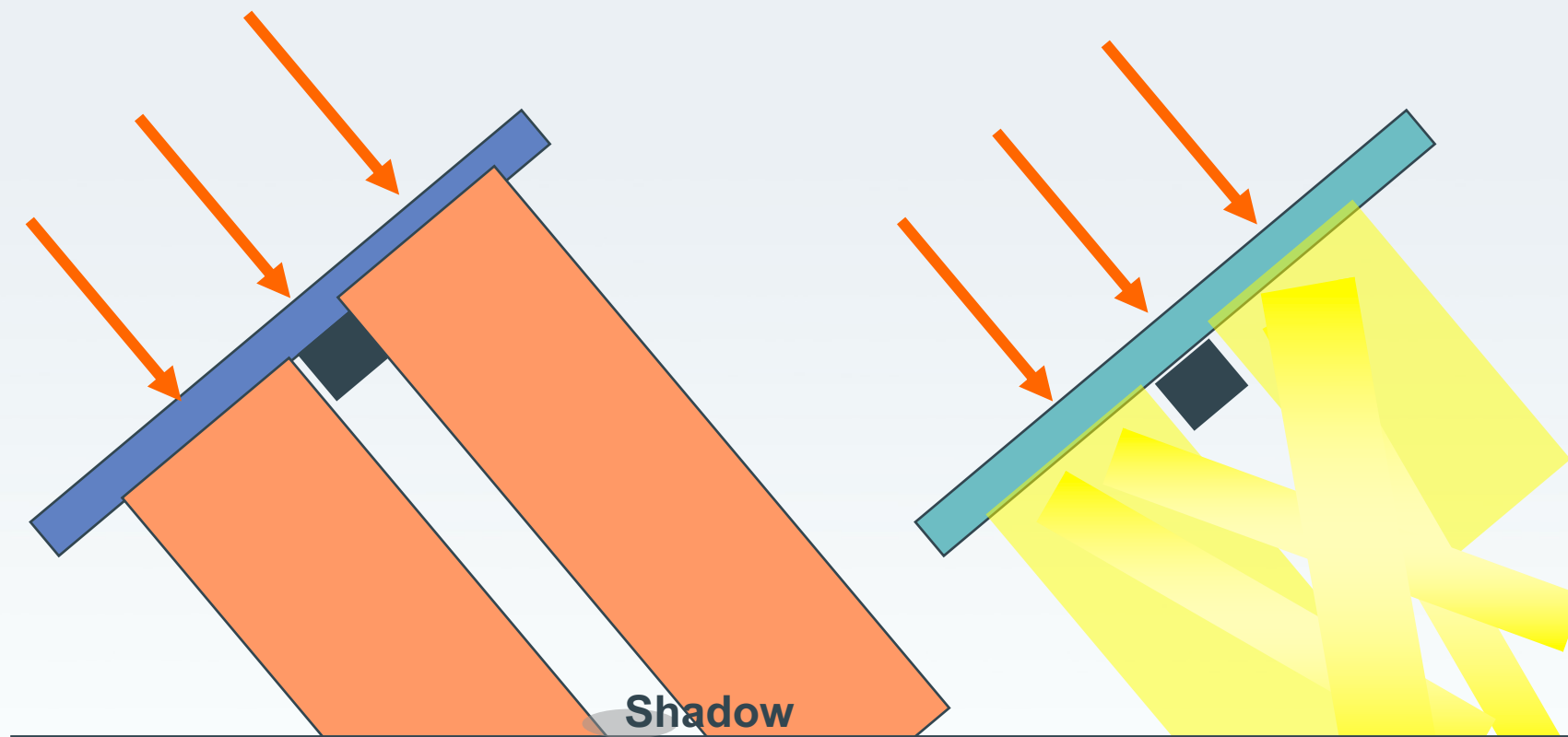
F-CLEAN Diffused vs. Clear



F-CLEAN Diffused



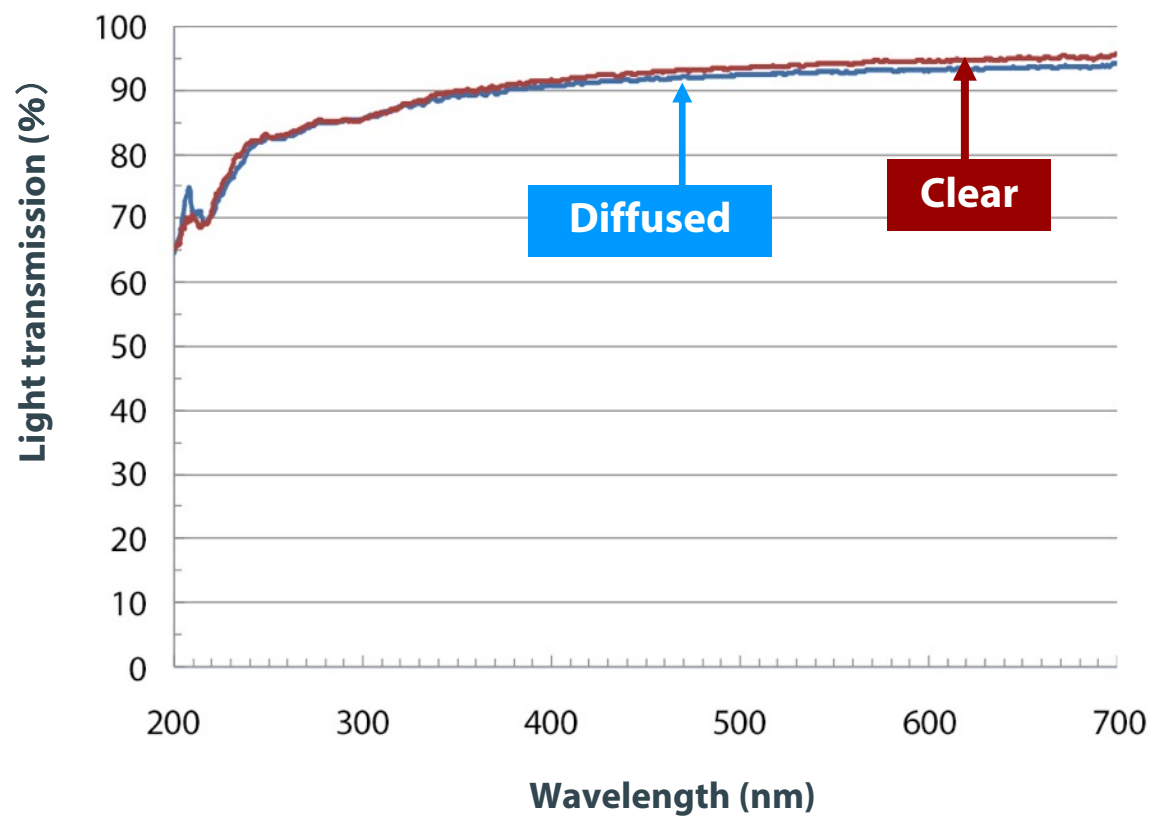
F-CLEAN Clear



F-CLEAN Clear

F-CLEAN Diffused

F-CLEAN Diffused

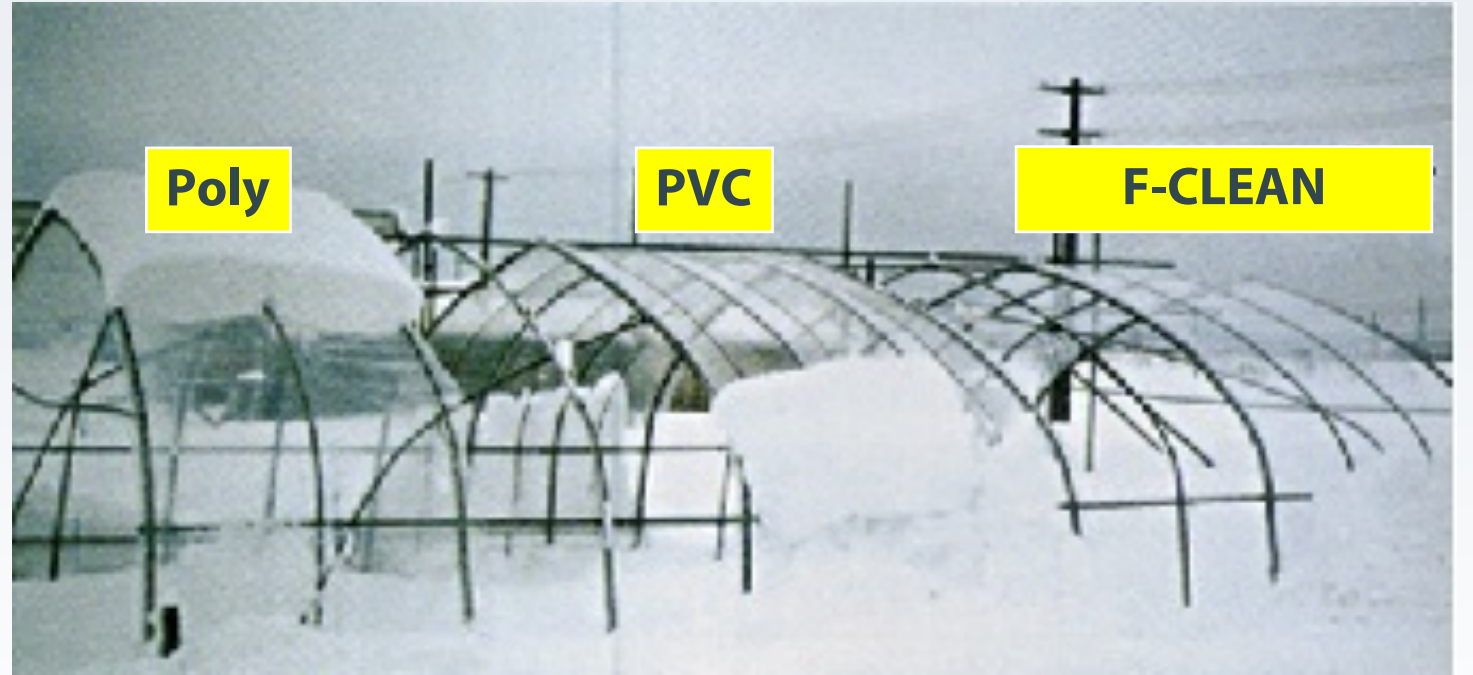


Non-Stick Properties

Poly

PVC

F-CLEAN



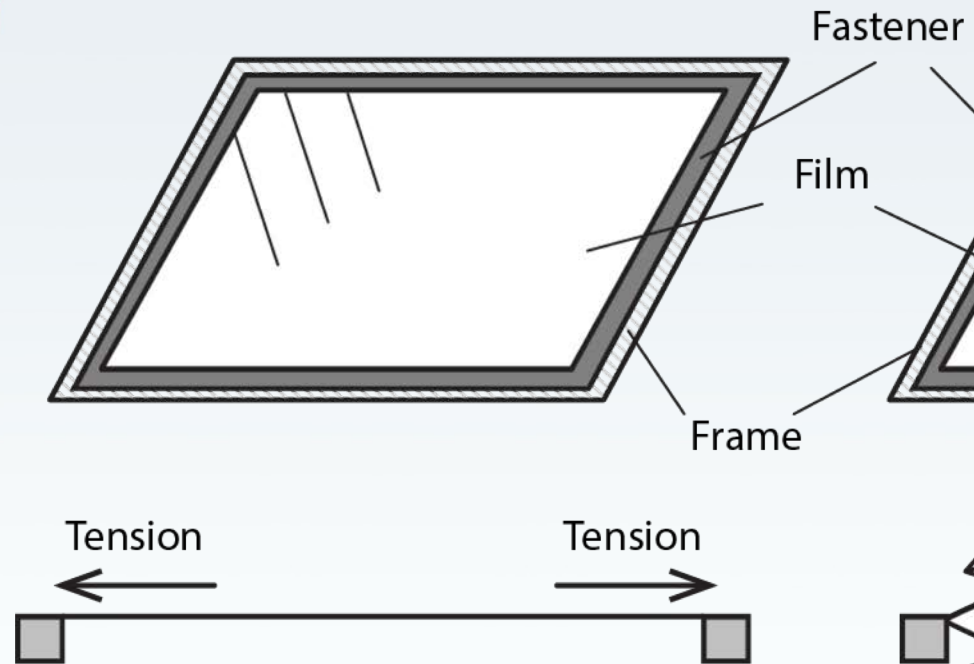
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Chemical Resistance

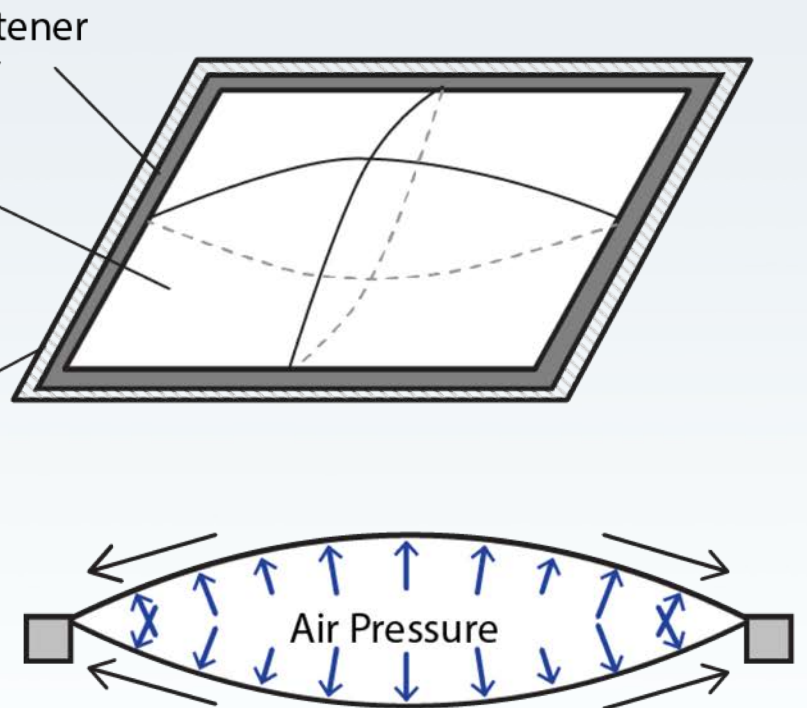
| Chemical | | Temp. (°C) | Days | Retention (%) | |
|-------------------------|-----|---------------|------|---------------|----------|
| | | | | Elong. | Wt. Gain |
| Conc. hydrochloric acid | 35% | 100 | 10 | 100 | 0.0 |
| Sulfuric acid | 78% | 121 | 10 | 100 | 0.1 |
| | 98% | 121 | 10 | 100 | 0.0 |
| 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 |

Installation Type

Single Layer



Multilayer Cushion



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

Miyagi, Japan

Crop: Paprika

Area: 50.000 m²

Installed: 2010

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



Germany

Crop: Lettuce

Area: 15.000 m²

Installed: 2006

Grade: 100 mic/Clear





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)

AGC

Italy

Crop: Roses

Area: 4.000 m²

Installed: 2001

Grade: 100 mic/Clear



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AGC

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)

USA

Crop: Potted flowers
Area: 100.000 m²
Installed: 2003
Grade: 100 mic/Clear





China

Crop: Potted flowers

Area: 10.000 m²

Installed: 2010

Grade: 100 mic/Clear+60/Diffused

Russia

Crop: Cucumber

Area: 200.000 m²

Installed: 2011

Grade: 100 mic/Diffused





Taiwan

Crop: Strawberries

Area: 1.600 m²

Installed: 2014

Grade: 100 mic/Diffused (UV Block)



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)



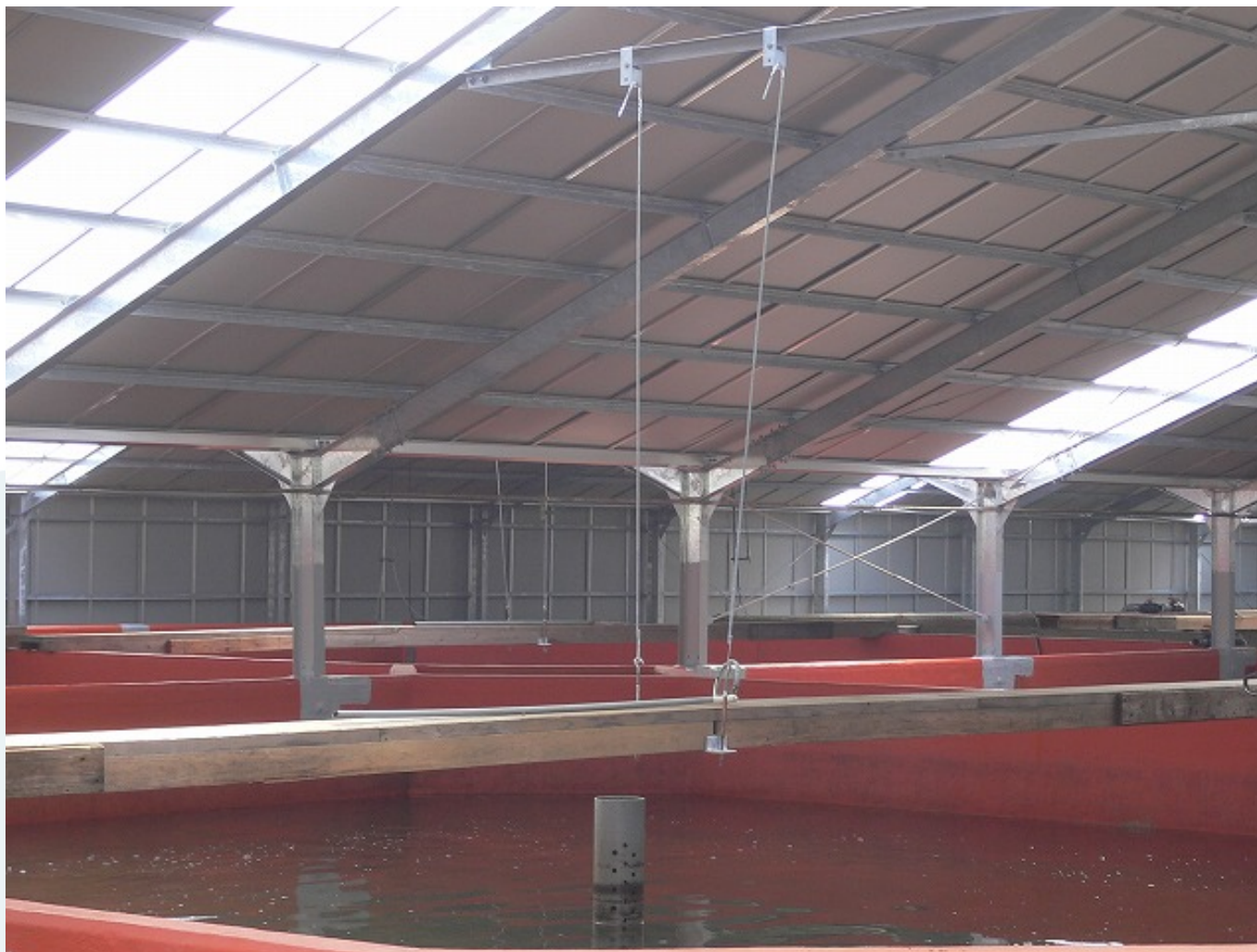
Japan

Crop: Fish

Area: 5.000 m²

Installed: 2012

Grade: 100 mic/Gray



Japan

Crop: Shrimp

Area: 2.300 m²

Installed: 2012

Grade: 100 mic/Gray



AGC

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



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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For More Information:

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