

F-CLEAN®



AGTC

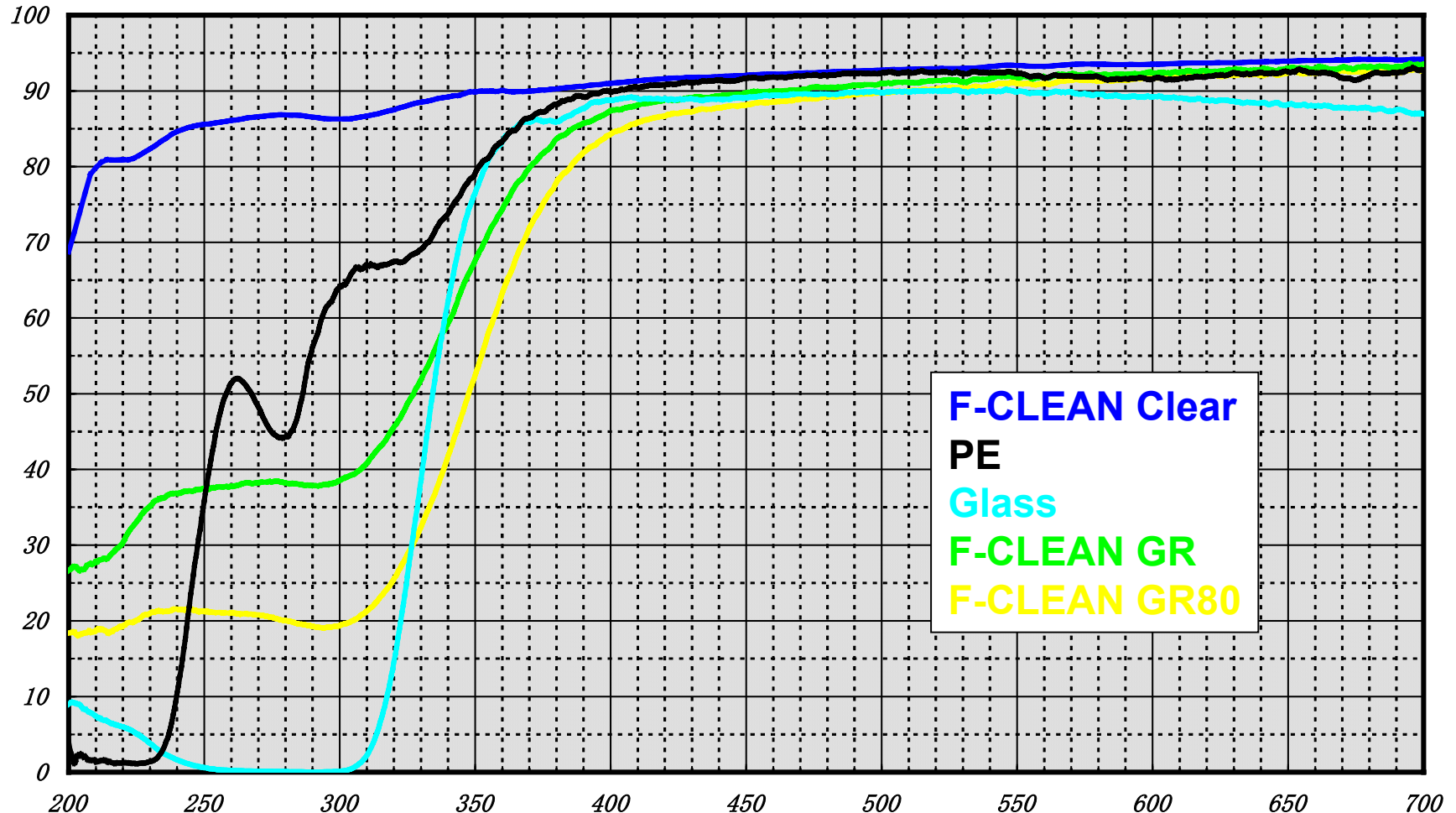
Asahi Glass Green-Tech Co.Ltd.

F-CLEAN is the plastic foil made from 100% ETFE (Ethylene-tetra-fluoride-ethylene)

< Bull points about F-CLEAN >

- 1. Excellent PAR transmission**
- 2. Excellent UV transmission**
- 3. Low reflection ratio**
- 4. Excellent mechanical strength**
- 5. Excellent aging resistance**
- 6. Excellent chemical resistance**
- 7. Low U-value (=High R-value)**
- 8. and more.....**

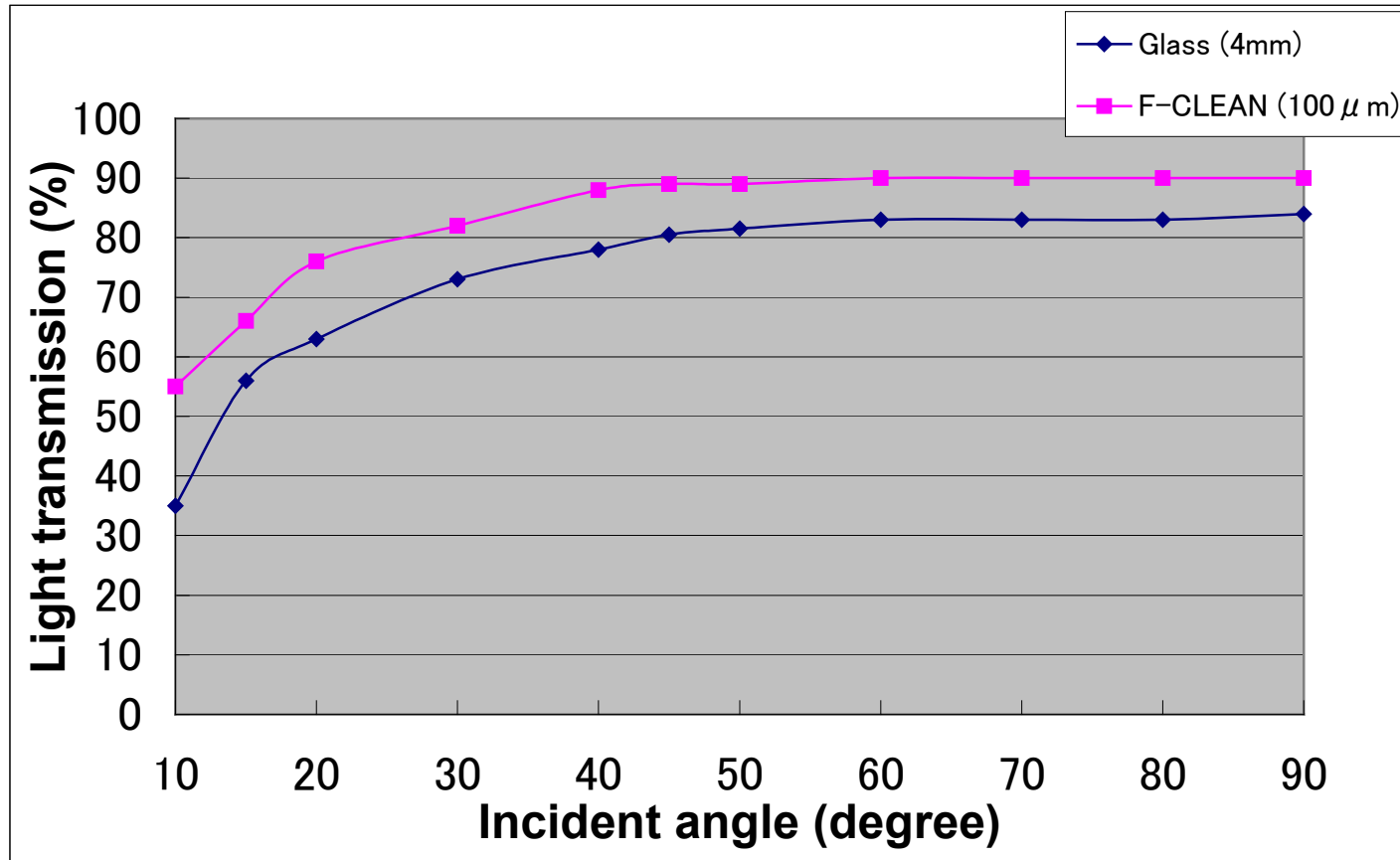
Excellent Light transmission



Light transmission of F-CLEAN (60micron) is 94%!!

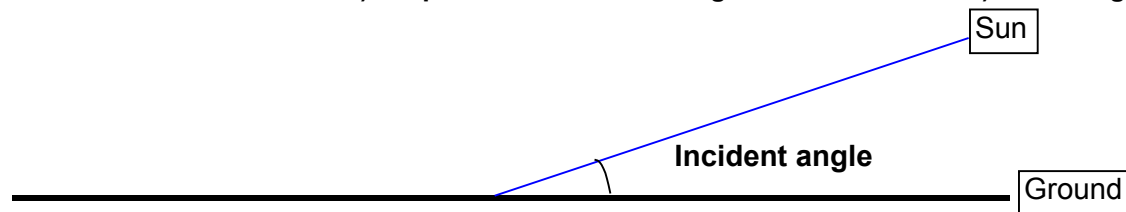
*Light transmission is measured according to JIS standard.

Low reflection



1) Wavelength of the measurement: 200 to 2500nm

2) Graph out the converted figure of the result of 1) according to JIS-R310





2 layer of F-CLEAN

2 layer of PE

**Under 2 layer
of F-CLEAN**

**Under 2 layer
of PE**



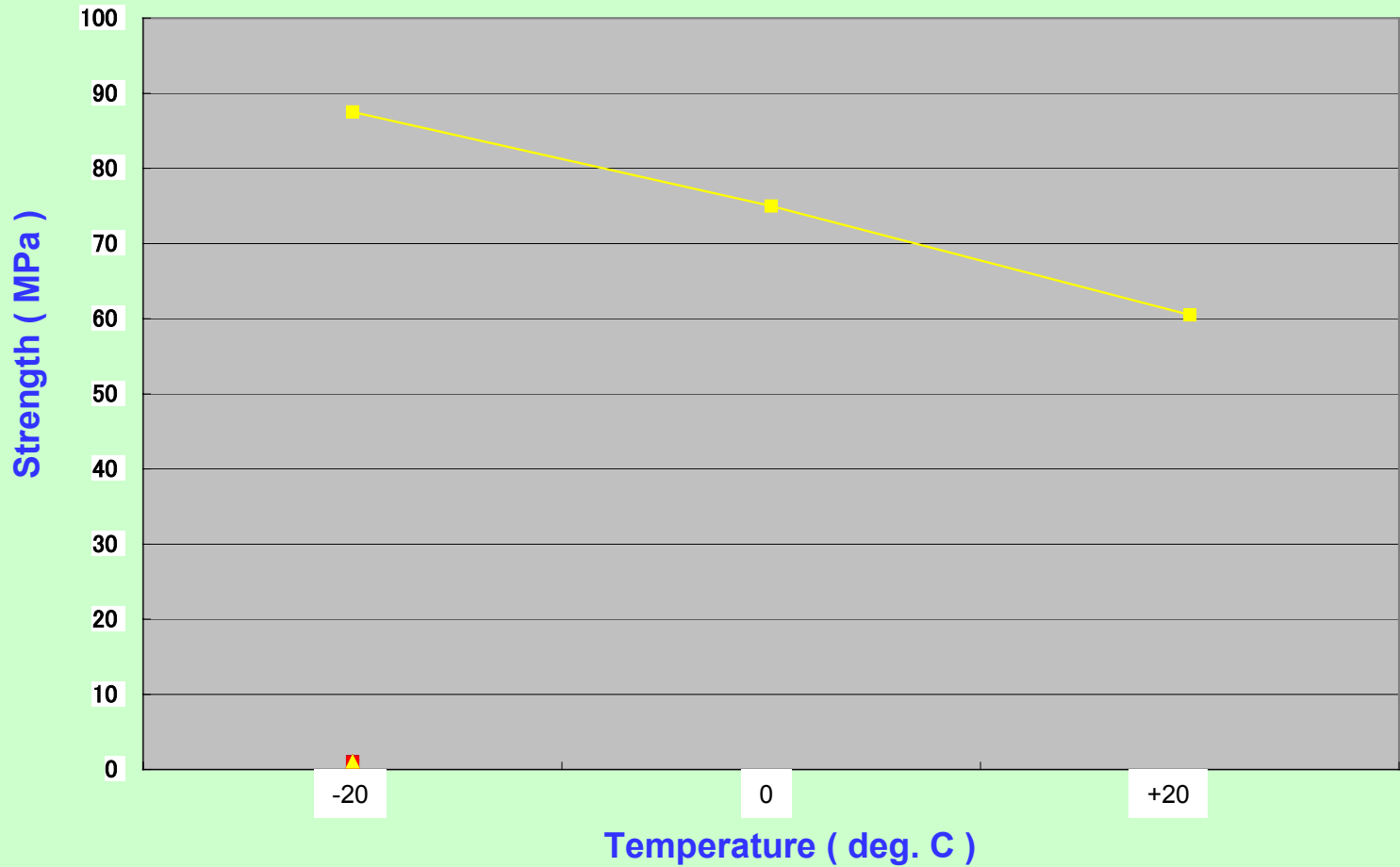
Excellent mechanical properties

Producer	AGC	AT Plastics	Ginegar	Hyplast	Plastika Kritis	Visqueen
Film name	F-CLEAN	Dura 3	Sunsaver	HYTILUX	Sunmaster	Luminance
Thickness(μm)	100μm	150μm	200	200	150	150
Tensile strength at Break	58MPa	25.6MPa	21.2MPa	23MPa	22MPa	–
Elmendorf tear strength	21N	7.5N	–	–		–
Elongation at break	400%	658%	–	550%	500%	–

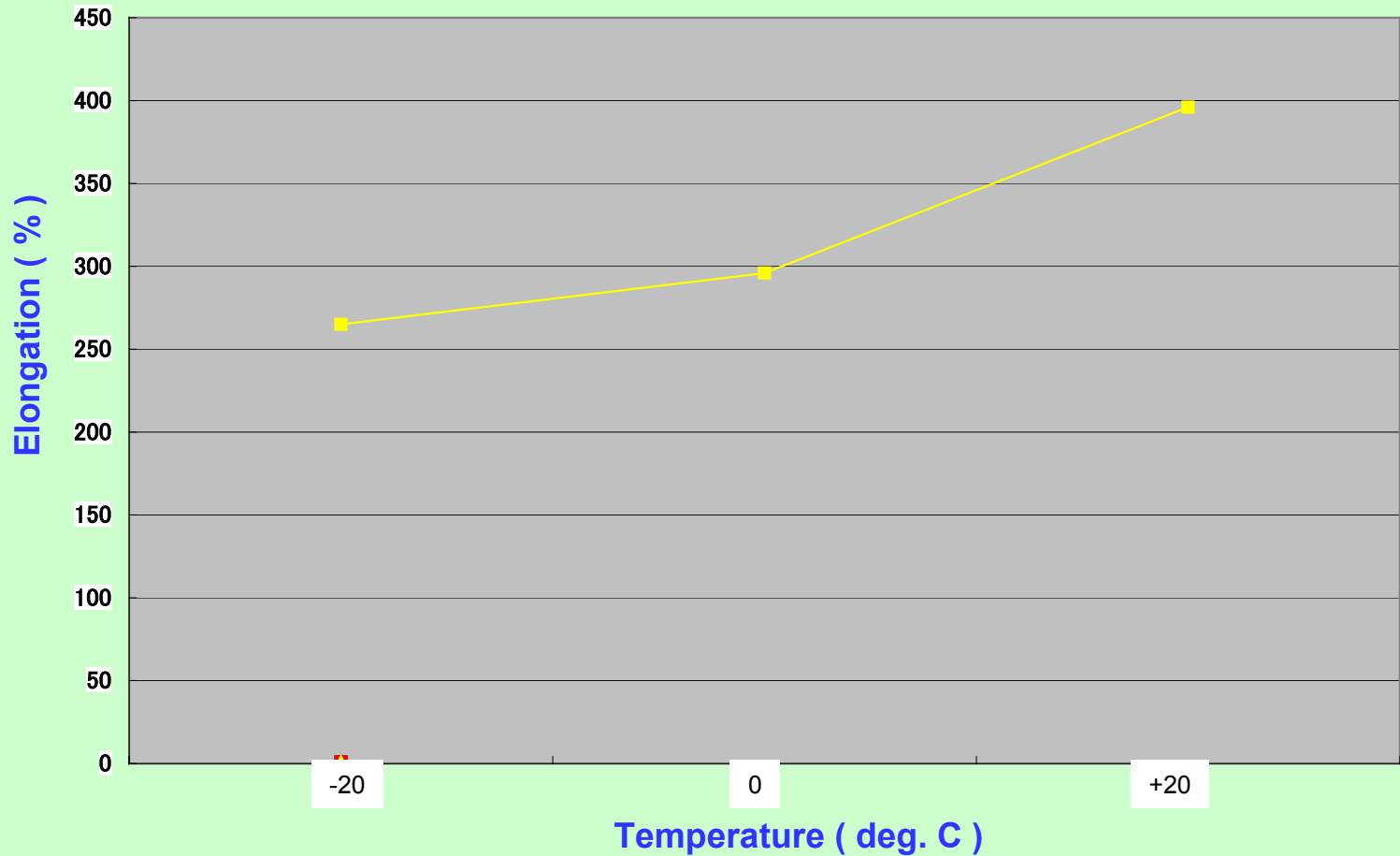
F-CLEAN is twice as strong as PE film.

Please feel its strength!!

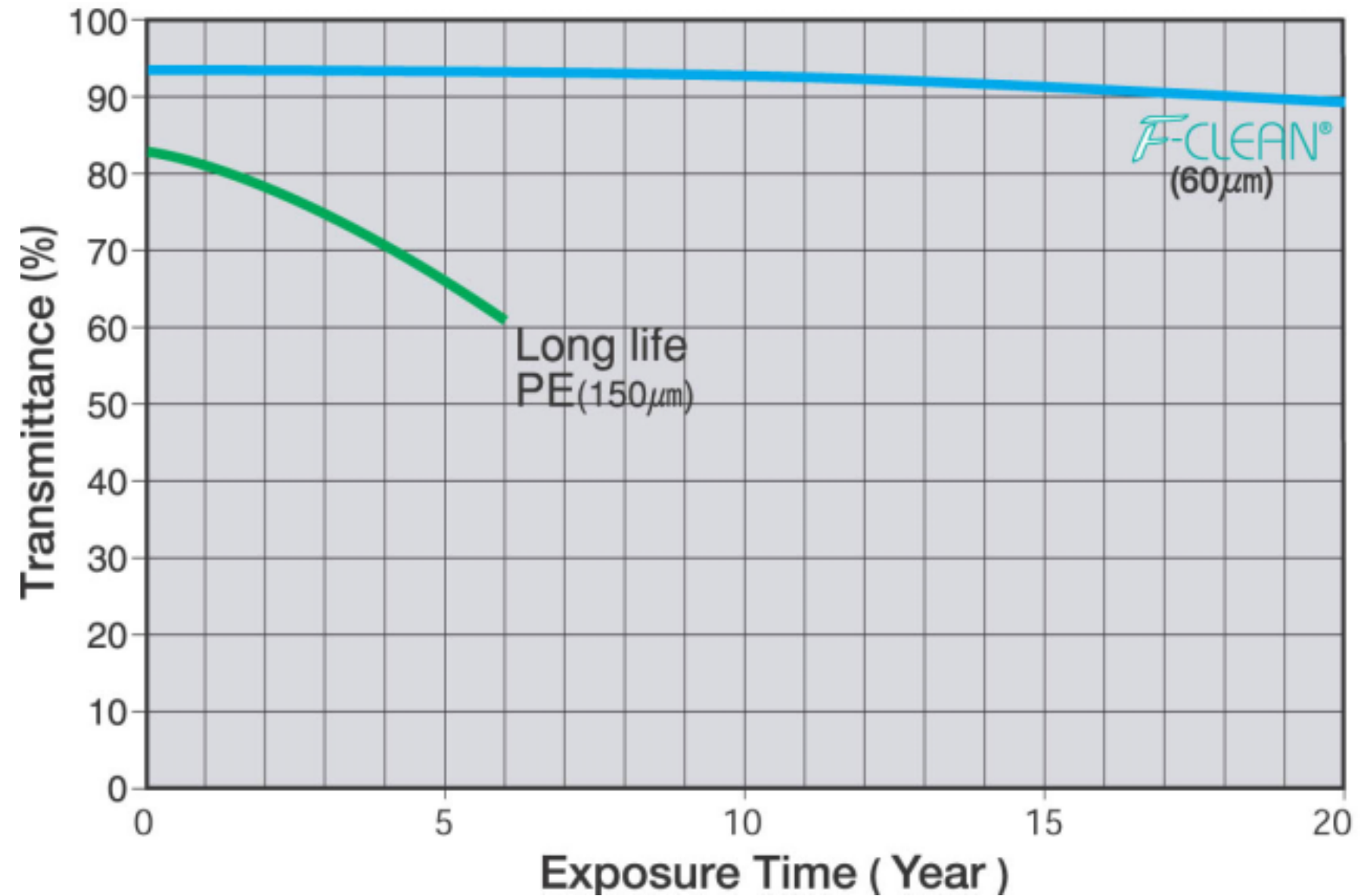
Tensile strength with temperature change



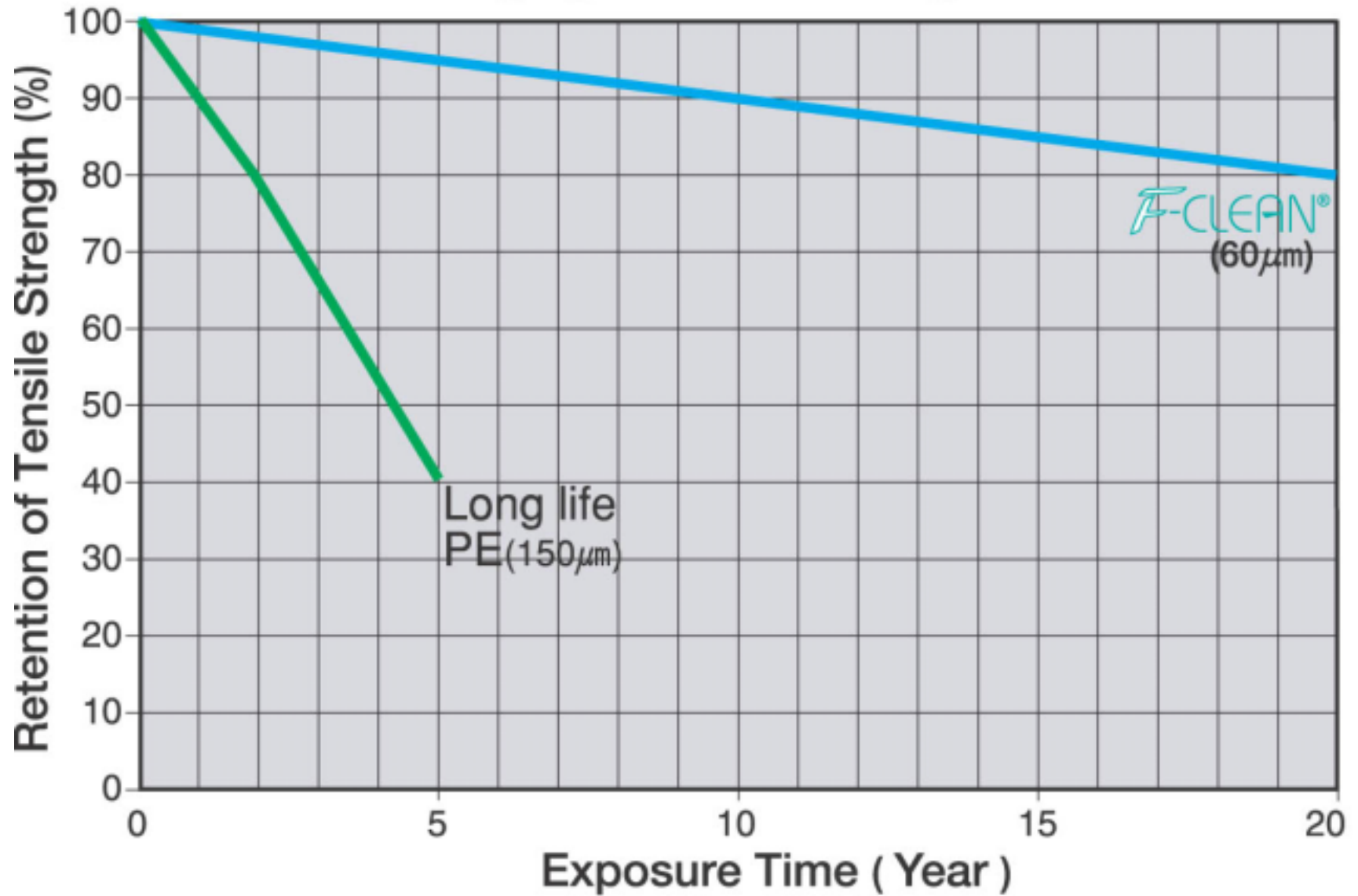
Tensile elongation with temperature change



Aging of Light transmittance



Aging of Tensile strength



Excellent durability



Installed in 1988



Installed in 1988

U-value

	Covering	Thickness		U-value	
		micro meter	mil	W/(m ² ·K)	{kcal/(m ² h°C)}
1	F-CLEAN / Clear / 100μm (4mil) / WT	100	4	5.5	4.8
2	F-CLEAN / Clear / 60μm (2.4mil) / WT	60	2.4	5.5	4.7
3	F-CLEAN / Clear / 60μm (2.4mil) / WT (11years old)	60	2.4	5.3	4.6
4	F-CLEAN / GR80 / 100μm (4mil) / WT	100	4	5.5	4.7
5	F-CLEAN / Diffused / 100μm (4mil) / WT	100	4	5.6	4.8
6	Glass	3mm	120	6.0	5.1
7	Glass	6mm	240	5.9	5.0
A	F-CLEAN / Clear / 100 μ m (4mil) / WT + F-CLEAN / Clear / 100 μ m (4mil) / WT	100 + 100	4 + 4	2.7	2.3
B	F-CLEAN / Clear / 100 μ m (4mil) / WT + F-CLEAN / Clear / 60 μ m (2.4mil) / WT	100 + 60	2.4 + 2.4	2.5	2.2

Precondition for calculation: Distance between films is 500mm (=20 inches)

Achievements (Greenhouse application)



Tomato (Kumamoto, Japan) 14



Orchid (Osaka, Japan)



Begonia (Ehime, Japan)



Cyclamen (Gunma, Japan)



Lily (Fukushima, Japan)



Groliosa lily (Kouchi, Japan)



Mum (Kouchi, Japan)



Young-plant of lettuce (Germany)



Rose (Italy)



Young-plant of lettuce (Germany)



Young-plant of lettuce (U.K.)



Young-plant of Carnation (U.S.A)



Mum (Korea)



Young-plant of tomato (U.S.A.)

Achievements (Architectural application)



Allianz Arena (Football stadium)

Germany



Allianz Arena (Football stadium)

Germany



AWD-arena (Football stadium)

Germany



Massanutten Aquatic Center

U.S.A.

Achievements (Other application)



Hot house for natural salt

Japan



Greenhouse on Mars (Prototype)

U.S.A.



Grey film

Cow house (Japan)



Grey film

Disposal plant of human excrement
Japan



Grey film

Sewage facility
Japan

Crop response 1

Location: Munich, Germany
Crop: Young plant of roman lettuce

Installed on: Feb. 2003
Photographed on: Sep.2003



- Young plant grown under F-CLEAN became more robust, more resistant to sudden climate change.
- As a result, time consuming work of getting the plants familiarized to Sun light has been omitted.

Right: Under F-CLEAN
Left::Under PE

Crop response 2

Location: Vicinity of Frunkfurt, Germany

Installed on: Apr. 2004

Crop: Young plant of lettuce

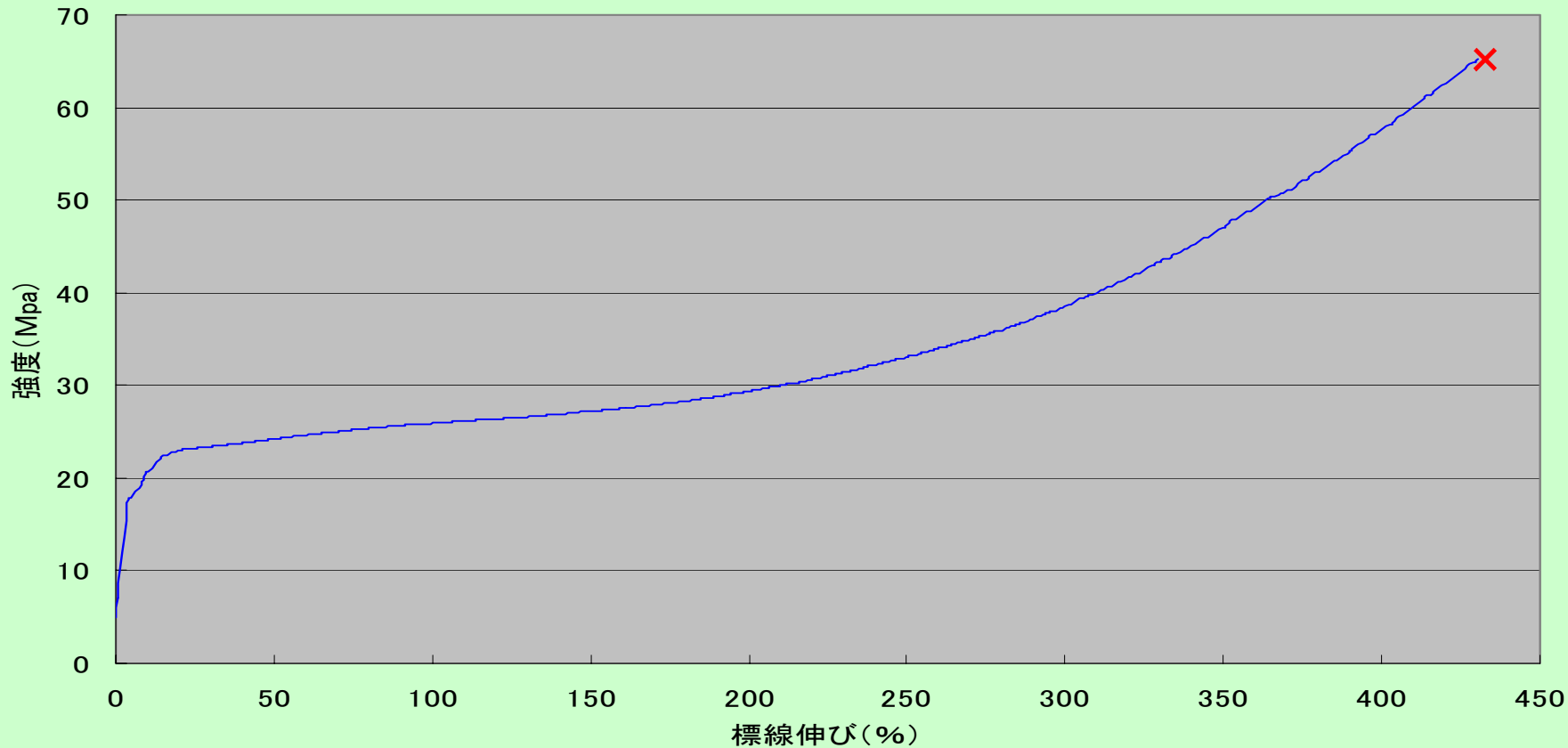
Photographed on: June. 2005



Left: Under F-CLEAN

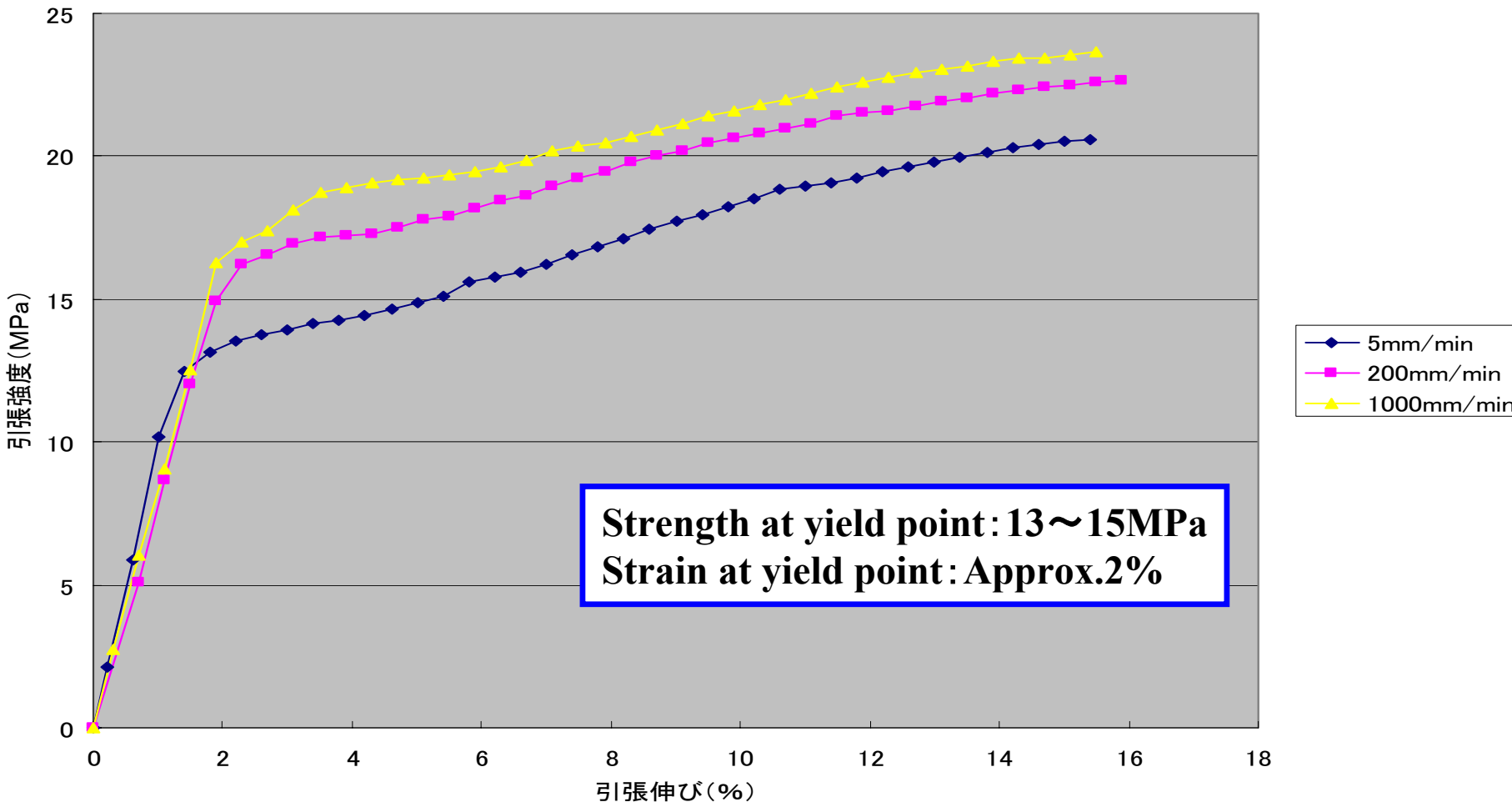
Right :Under Glass

S-S curve



Tensile strength at break (mean value): 60MPa
Tensile elongation at break (mean value): 406%

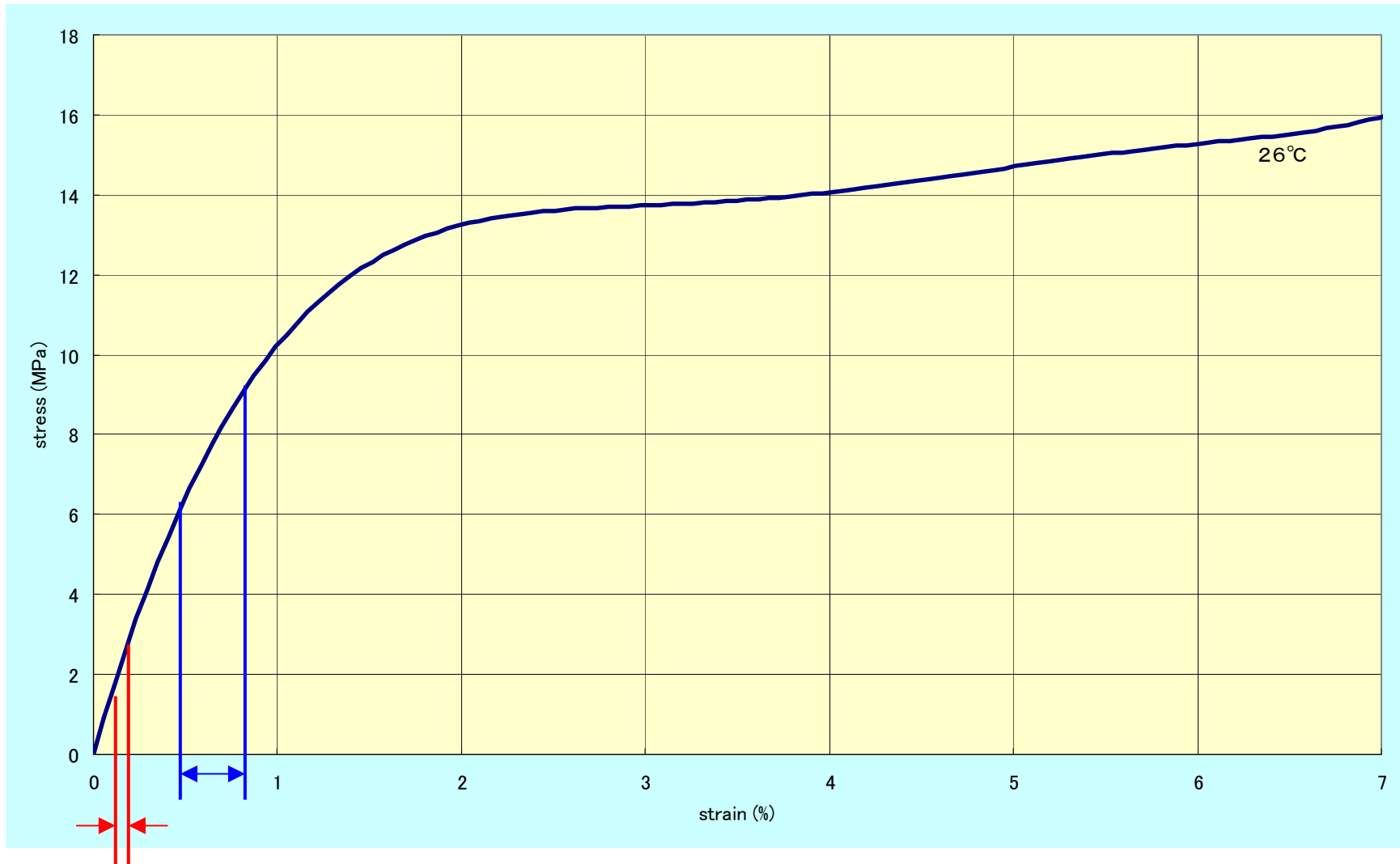
S-S curve



Consider the thickness of film and the perimeter of the fastener/unit to satisfy the following formula.

[Stress on the film occurred by external load < Strength at Y.P]

Optimal tension



↔ For single layer

↔ For air-inflated

Achievement of F-CLEAN double layered greenhouse

Strawberry house



Hokkaido, Japan

Upper : 100 μ m / Clear
Lower : 60 μ m / Clear

Strawberry house



Strawberry house



Tropical fruits house



Upper : 100 μ m / Clear
Lower : 100 μ m / Clear

Width : 15.9m x 60m
Top of roof : 10m
Gutter height : 3.175m

Hokkaido, Japan

Tropical fruits house



Tropical fruits house



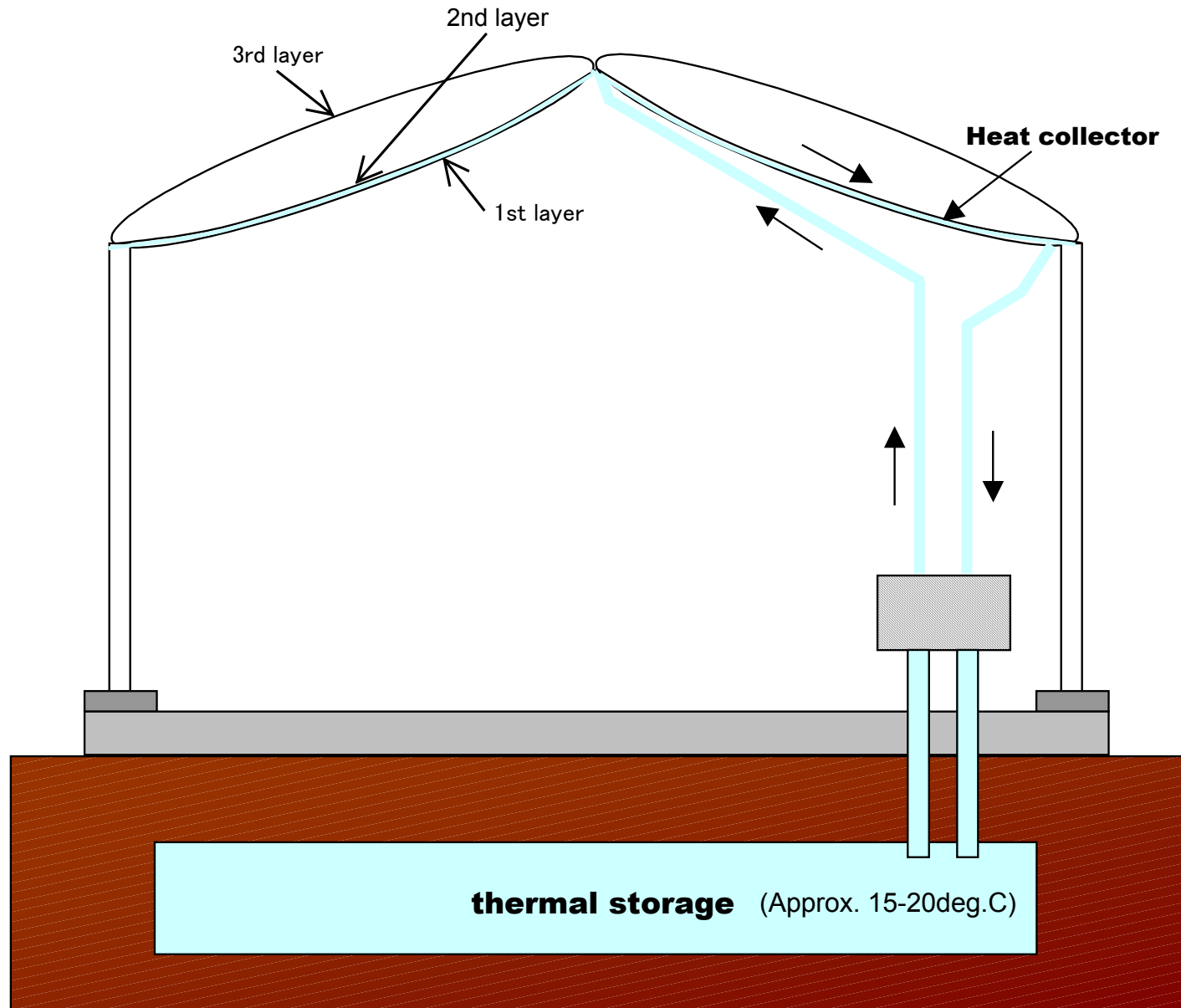
Snow depth: Approx. 80cm (2.7feet)

Research center



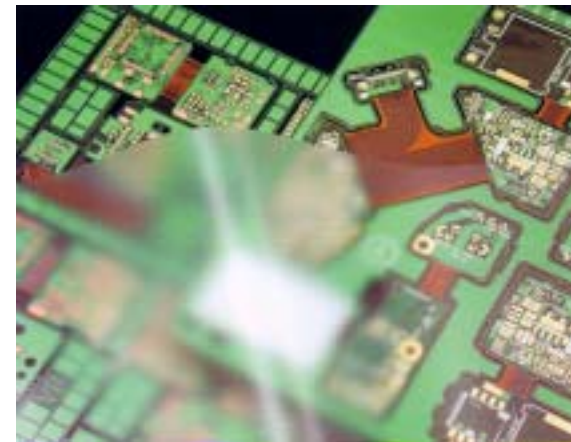
Tsukuba, Japan

Mechanism



Research center





Other products produced from ETFE

*ETFE is a raw material of F-CLEAN

