



Fluoropolymer for Coating



LUMIFLON®

Introduction

Introduction

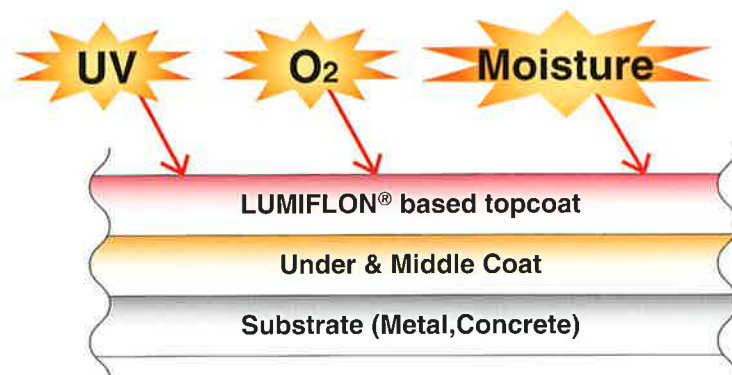
LUMIFLON® was developed and commercialized in 1982 by Asahi Glass as the first solvent-soluble fluoropolymer for coatings that can be cured under room temperature conditions. During this 20 years period, fluoropolymer coatings based on LUMIFLON® have been produced by many coating manufactures worldwide. LUMIFLON® based coatings maintain excellent appearances(gloss, color)on buildings and other structures for more than 20 years, and also protects steel and concrete from UV, wind, rain and corrosion. Therefore, LUMIFLON® based coatings reduce the total maintenance cost such as repainting or cleaning. Recently, Asahi Glass has developed environmentally friendly LUMIFLON® grades, such as emulsion and powder grades.

Features

Excellent Weatherability	LUMIFLON® has good chemical stability as fluoropolymer and shows excellent weatherability compared to other traditional top coatings.
Soluble in many common solvents	LUMIFLON® polymer can be dissolved in various organic solvents.
Curable under room temperature	LUMIFLON® gives you a choice of curing conditions from ambient to high temperatures. (5°C/41F to 230°C/446F)
Superior appearance	LUMIFLON® is a transparent fluoro resin, therefore both clear and enamel coatings are possible. LUMIFLON® also can attain gloss retention over 80%.

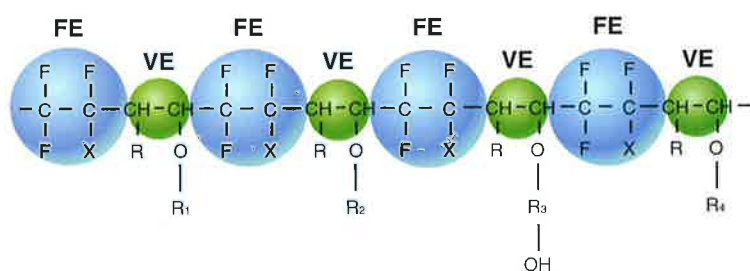
LUMIFLON® is used as a topcoat

☀️ =Corrosive factors



LUMIFLON® protects under & middle coat
In case of clear coatings, it is necessary to use UV adsorber to protect under layer system.

Polymer Structure of LUMIFLON®



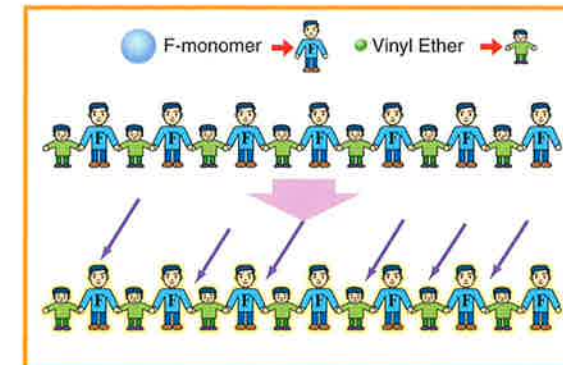
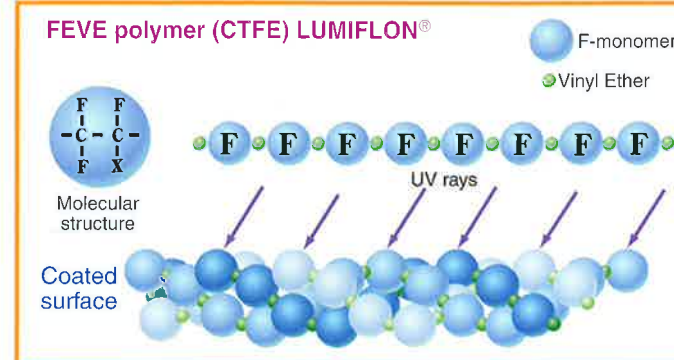
FE:Fluoro Ethylene
Durability

VE:Vinyl Ether
R1=Transparency,Gloss,Hardness
R2=Flexibility
R3=Crosslinkability
R4=Pigment compatibility,Adhesiveness

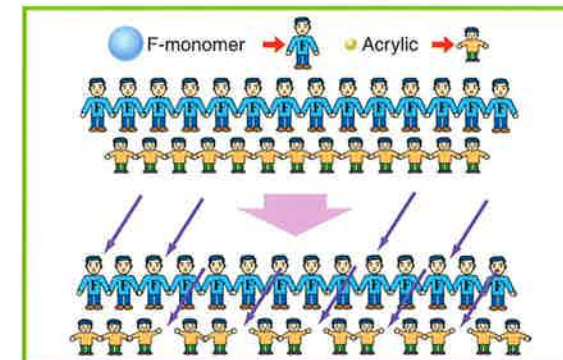
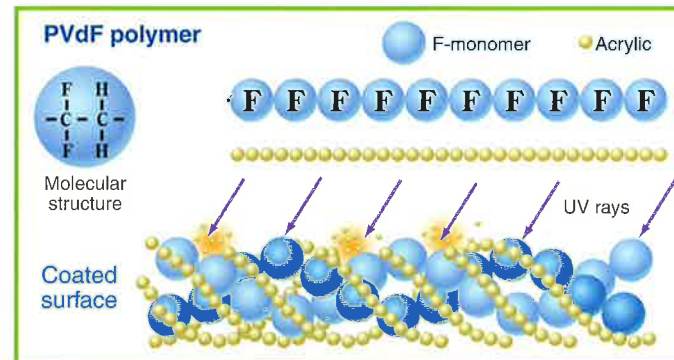
LUMIFLON® and PFEVE structure

High durability of the fluoropolymer is based on its C-F bond energy. The C-F bond energy is much larger than the energy of UV rays in sunlight. The C-F bond is capable to strengthen neighbor C-C main chain bond.

- The graphics on the left: The size of a sphere reflects the size of bond energy.
- The graphics on the right: The adult and child figures show each monomer.

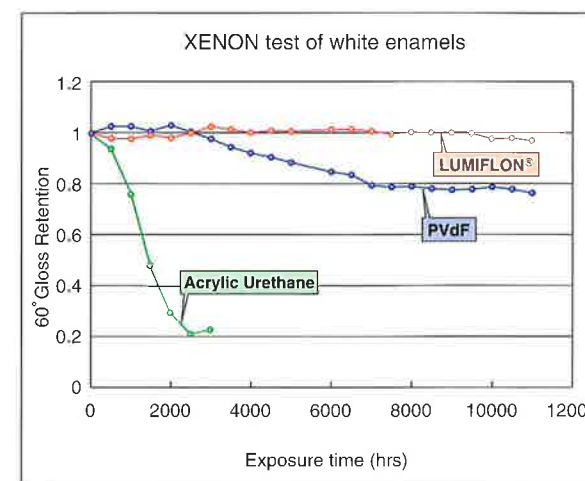


Fluoroethylene/vinyl ether copolymer (FEVE) comprises alternating sequence of fluoroethylene and several specific vinyl ether units and it is completely amorphous. This alternating sequence is responsible for the extremely high weather resistance of the resultant paint finishes. The chemically stable fluoroethylene unit protects the neighbor vinyl ether unit, which can be easily attacked by UV rays and other corrosive factors.

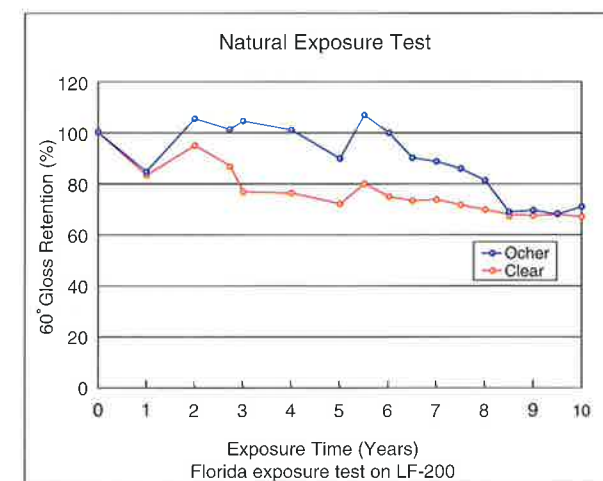


The weatherability of PVdF itself is high; on the other hand, it is necessary to add acrylic resin in order to formulate PVdF into coatings. Because acrylic resin is easily attacked by UV rays, the amount of acrylic resin added to PVdF resin is very important.

Gloss retention in commercial coatings



Gloss retention according to AAMA 2605



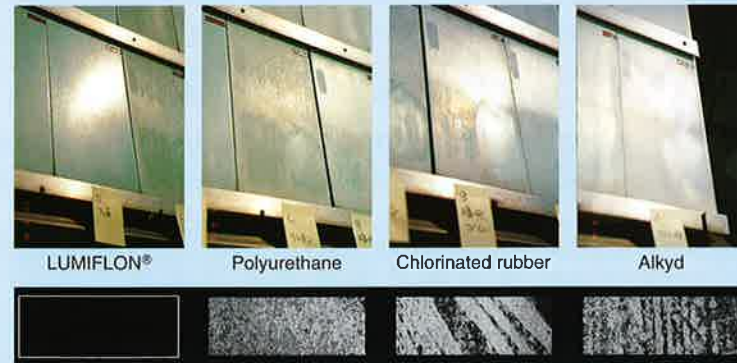
Test Method:ASTM
Type of test:Direct 30 DEG SOUTH, OPEN BACK
Location:Exposed in Miami, Florida

Superior Durability

Different fluoropolymers for coatings

Test Panels after 15 years

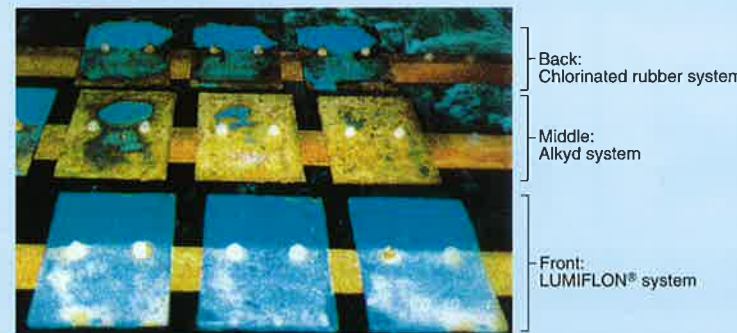
- When: 1985
- Where: 5 km from the ocean
- New/Repaint: New
- How long: 15 years



Chalking(Taping test)

Test Panels after 5 years

- When: 1995
- Where: By the ocean
- New/Repaint: Repaint
- How long: 5 years



Back: Chlorinated rubber system

Middle: Alkyd system

Front: LUMIFLON® system

The building after 18 years

- Name: ARK Mori Building
- When: 1983
- Where: Tokyo, Japan
- New/Repaint: New
- How long: 18 years



Name: Koushinmaru
LUMIFLON®: Solvent
Substrate: Fiber reinforced plastic

Bridge after 14 years

- Name: Daiichi Mukaiyama bridge
- Where: Mountain area
- When: 1987
- New/Repaint: New
- How long: 14 years



LUMIFLON® part: Gloss is still high



Arch part: LUMIFLON® Closer part: Alkyd



Alkyd part: Peeling has occurred



LUMIFLON® part: No chalking



Alkyd part: Chalking and discoloration have occurred

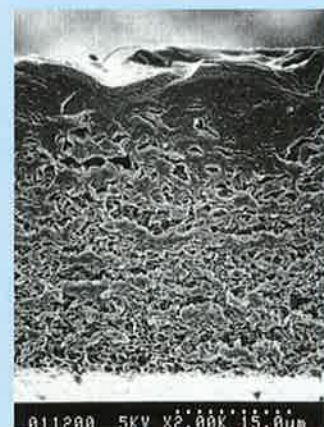
The expected anti-corrosive effect standardized by Japanese Society of Steel Construction Authority

		General environment	Severe environment
		*Not salty *No effect from exhaust gases or factory smog	*Very salty *Severely polluted by exhaust gases or factory smog
General coating	General coating	10 years	Not applicable
	Heavy duty coating	30 years	20 years
	Fluoropolymer coating	50 years	30 years

Japanese society of Steel Construction, 2002. Toward LCC reduction of bridge coating: Comparison of bridge corrosion prevention method, October,22.

Acid resistance test

< Scanning electron microscope study-10% sulfuric acid 70°C×3hrs>

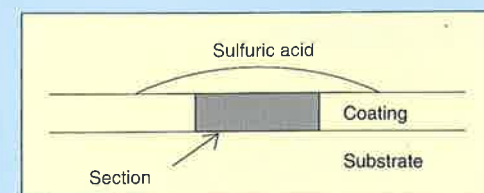


Acrylic

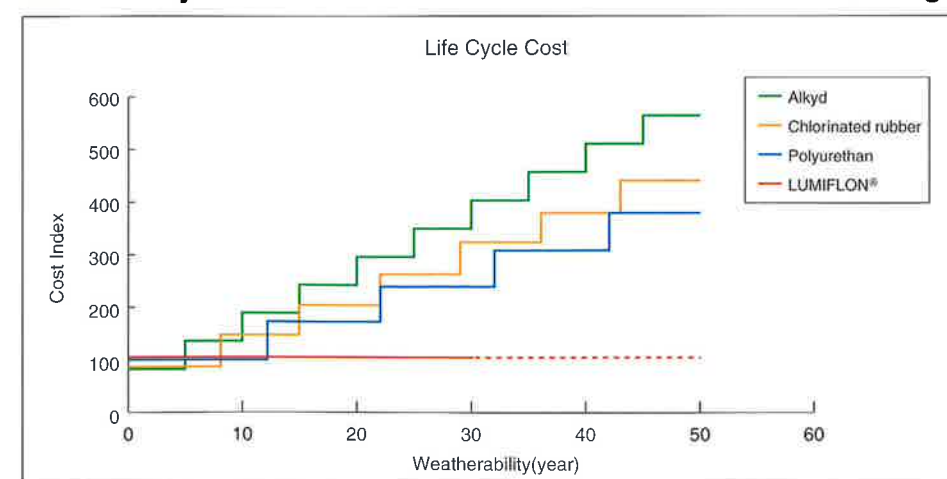


LUMIFLON®

Inside of spotted film was shot and upside is its surface.
The picture shows that acrylic melamine film was found to be porous, and thicker than the initial film, about 34 μ m. On the contrary, there were no significant changes on LUMIFLON® film.



The life cycle cost of LUMIFLON® and other commercial coatings



*This figure is based on the calculation of Japanese paint and coating cost in 2001.



Name: NTT Sekimoku Network Center
LUMIFLON®: Solvent
Substrate: Iron

Comparison of LUMIFLON® and PVdF

Why do you choose LUMIFLON®?

	LUMIFLON®	PVdF
Resin Type	Solution	Dispersion
Curing Temp.(°C/F)	Room temp. to 230/446	>250/482
Gloss	5 to 90%	5 to 35%
Color Range	More than 230 colors	Color is limited
Recoatibility	Excellent	Poor

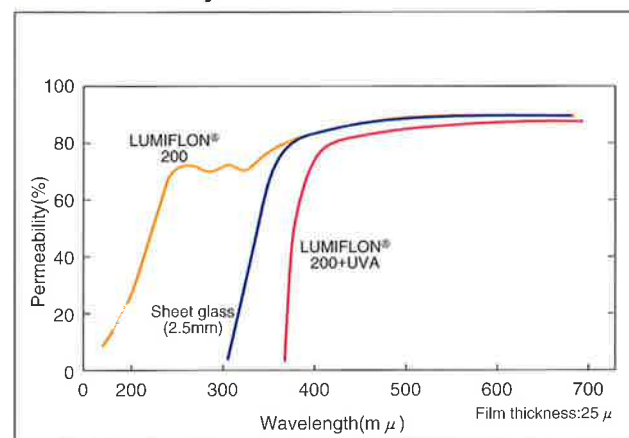
Transparency of LUMIFLON® based clear coatings

LUMIFLON® shows the great transparency under the visible ray that is almost as same as a sheet glass. The clear film using LF200+UVA keeps the high permeability and shut out UV rays at the same time.

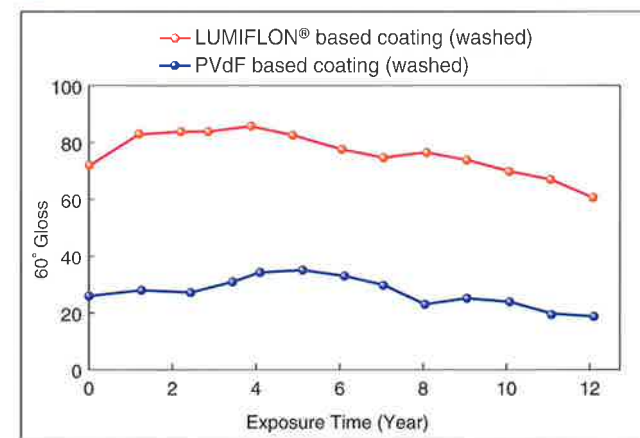
	LF-200 with UVA		PVdF
Exposure time(hrs)	0→1500	0→1500	0→1500
Curing agent	Isocyanate	Melamine	—
Haze(%)	0.5→2.9	0.4→2.7	13→36
Yellow Index(—)	0.6→3.2	0.9→3.0	9.7→14

PVdF was blended with acrylic resin
QUV condition: Irradiation 70°C×8hrs
Condensation 50°C×4hrs

Permeability of LUMIFLON® clear film



Gloss retention between LUMIFLON® and PVdF



Exposed at OKINAWA (Latitude 26.5°, longitude 128°)
Color: Brown



Name: Shinjyuku Mitsui Building
LUMIFLON®: Solvent
Substrate: Aluminum



Name: Incinerator
LUMIFLON®: Solvent
Substrate: Concrete



Name: Ofuna Kannon
LUMIFLON®: Solvent
Substrate: Concrete

LUMIFLON® solvent

Application areas

Application areas	*Architecture *Coil coating *Industrial *Heavy duty *Automotive *Aerospace *Marine *Repaint
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Name: Yushima Tenjin
LUMIFLON®: Solvent
Substrate: Concrete



Name: Boeing Aerospace Building
LUMIFLON®: Solvent
Substrate: Aluminum

LUMIFLON® solvent grade

Grade	LF-552	LF-600X	LF-200	LF-906N	LF-910LM
Features	Flexible	Flexible	Standard	High Tg	Low VOC
Applications	Coil coating	Coil coating	General	Heavy duty Aerospace	Heavy duty Aerospace
Resin properties					
Type of M.W	High				
Tg(°C/F)	20/68	20/68	35/95	45/113	37/99
OH Value(mg KOH/g-Polymer)	52	50	52	76	100
Acid Value(mg KOH/g-Polymer)	5	0	0	0	0
Varnish properties					
N.V.(wt%)	40	50	60	65	66
Specific Gravity(as varnish)	1.06	1.08	1.12	1.15	1.16
Solvent	Solvesso150 cyclohexanone	Xylene	Xylene	Xylene	Xylene



Name: Akashi straight bridge
LUMIFLON®: Solvent
Substrate: Iron



Name: ANA Airplane
LUMIFLON®: Solvent
Substrate: Aluminum alloy



Name: Bullet train "Max"
LUMIFLON®: Solvent
Substrate: Iron



Name: Norfolk International Airport
LUMIFLON®: Solvent
Substrate: Aluminum

Emulsion

LUMIFLON® Emulsion

Application areas

Application areas	*Architecture
	*Metal
	*Industrial
	*Plastic
	*Repaint

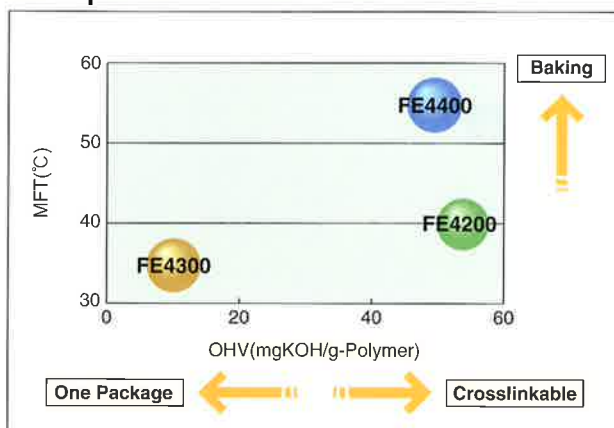


Name: Takashimaya
LUMIFLON®: Emulsion
Substrate: Concrete

LUMIFLON® Emulsion grade

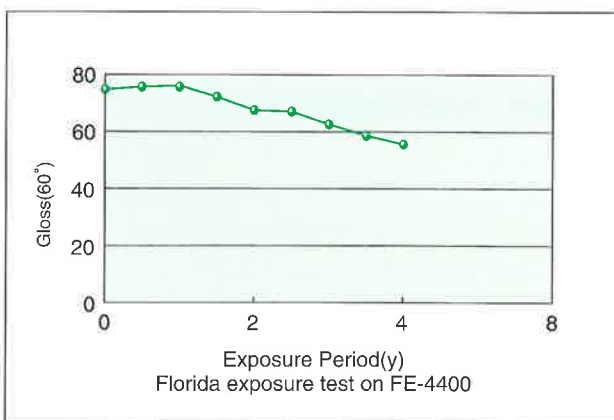
Grade	FE-4200	FE-4300	FE-4400
Features	High OH value/Low Tg Crosslinkable	Low OH value/Low Tg One component	High OH value/High Tg Crosslinkable
N.V.(wt%)		50	
PH	7-9	7-9	7-9
Average particle diameter (μ)	0.1-0.5	0.1-0.5	0.1-0.5
Ionic character	Anion	Anion	Anion
Specific gravity	1.17	1.13	1.16
OH Value (mg KOH/g-Polymer)	54	10	49
Minimum Film Forming Temperature(°C/F)	40/104	35/95	55/131

Properties of LUMIFLON® Emulsion



Name: Shinjuku Center Building
LUMIFLON®: Emulsion(Repaint)
Substrate: Concrete

Gloss retention of LUMIFLON® Emulsion



Hardener:Water dispersible NCO
Color:White
Substrate:Cement Board



Name: Mihama Estate
LUMIFLON®: Emulsion(Repaint)
Substrate: Fiber reinforced plastic



Name: Okayama Castle
LUMIFLON®: Emulsion
Substrate: Concrete

Flake

LUMIFLON® Dry Flakes

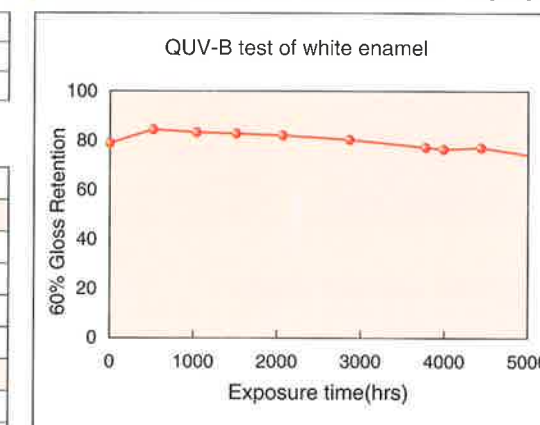
Application areas

Application areas	*Architecture
	*Coil coating
	*Heavy duty

LUMIFLON® Flake grade

Grade	LF-710F
Resin properties	
Tg (°C/F)	51.5/125
Softening point (°C/F)	90/194
OH Value (mg KOH/g-Polymer)	46
Acid Value (mg KOH/g-Polymer)	0
Varnish properties	
N.V. (wt%)	100
Solvent	none

Gloss retention of LUMIFLON® Powder



Color: RAL 9003

Features of LF-710F

LF-710F...	resin is the source to make super durable hydroxy functional powder coatings.
	resin based powder coating can be produced with conventional facilities.
	based powder coating can attain one's desired gloss.
	based powder coating can attain various finishing from clear to many colors.
	based powder coating reduce cost competitive against PVdF system.

LF-710F recommended powder facilities

Process	Powder facility	Example
Mixing	Common mixer	Henschel, Mixaco
Extruding	All type of extruder	Single, Twin screw & Planetary
Grinding	Various mills without cryogenic	ACM, Turbo, Jet
Classification	Common classifier	Mesh, Air classifier

Extruding Condition

Type	Twin screw (Thermo Prism 16mm)
Heat up temp.(°C/F)	120/248
Screw rotation(rpm)	250
Feed rate	2.5kg/hour

Application method

Coating Equipment	Yes/No
Electric static gun	Yes
Fluidized dipping	Yes
Tribomatic gun	No

Positive charge control agent is necessary!



Name: Bennelong Apartment
LUMIFLON®: Powder
Substrate: Aluminum(Window frame)



Name: Puri Bank
LUMIFLON®: Powder
Substrate: Aluminum(Window frame)

*These pictures are provided by ORICA POWDER COATINGS.



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