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Chemistry for a Blue Planet
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LUMIFLON™

Fluorinated Resins for Ultra-Weatherable Coatings

LUMIFLON Resins for Bridges

Your Dreams, Our Challenge

Introduction

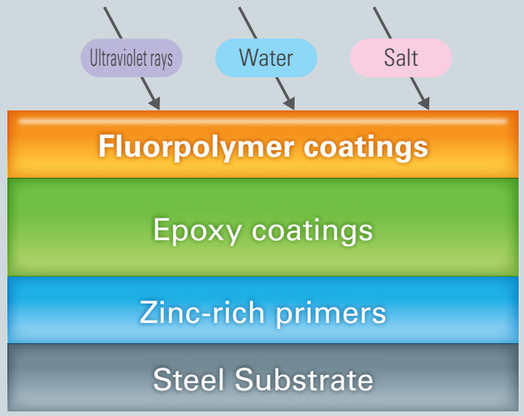
LUMIFLON™ was developed and commercialized by AGC in the early ‘80s and was the first solvent-soluble fluoropolymer for coatings.
LUMIFLON™ FEVE resins exhibit superior resistance to weathering.
They are used to formulate high performance coatings that maintain their appearance and protect against corrosion.
The use of LUMIFLON™ resins can substantially reduce life cycle costs, including maintenance costs, replacement costs, and re-coating, which leads to conservation of resources and a reduction in the emission of VOCs.
The results of long- term testing show the weatherability benefits of LUMIFLON™, but the real proof can be found on all the structures around the world utilizing LUMIFLON™ coatings.
LUMIFLON™ FEVE is a fluoropolymer resin that can be used in eco- conscious designs by extending the life span of structures and reducing life cycle costs.

FUNCTION

LUMIFLON™ has a performance record of more than 30 years in real world applications

LUMIFLON’s™ reliability has been verified by natural weathering experiments underway for more than 30 years.

Basics of Coating Systems in the New Handbook



(from the New Handbook on Painting and Corrosion Prevention of Steel Highway Bridges, March. 2014)

ISO 12944

ISO 12944 is an international standard for anti-corrosion coating systems. LUMIFLON’s™ chemical structure, **“fluoroethylene vinyl ether copolymer (FEVE)” is described as a “Special type of PUR”**

Coatings passed the new ISO 12944-6 standard, category C5 (very high corrosive environment) and ISO 12944-9 test protocols. Under ISO 12944-9, the coatings were tested under categories CX (corrosivity in offshore environments) and IM4 (immersion). Tests were performed by the independent research laboratory, COT in Haarlem, The Netherlands.

Excerpt from ISO 12944-5 6.2.5Paints for polyurethane coatings (PUR)

A special type of PUR is based on fluoropolymers.
Paints for fluoropolymer/vinyl ether co-polymer (FEVE) coating are two pack coating materials, and both water-borne and solvent-borne types are available. Solvent-borne paints dry by solvent evaporation and cure by a chemical reaction between a base resin and a curing component. Paints for FEVE coatings are ambient curable materinals cross-linked with isocyanate hardener.
The resin of base component is fluoropolymer with free hydroxyl groups which reacts with suitable isocyanate curing agents.
The drying time will depend, among other things, on air movement, relative humidity and temperature.

Paint system for carbon steel for corrosivity category C5

System No.	Priming coat				Subsequent coat (s)	Paint system		Durability			
	Binder type	Type of primer	No. of coats	NDFT in µm	Binder type	Total no. of coats	NDFT in µm	l	m	h	vh
C5.04	EP, PUR, ESI	Misc.	1	80 to 200	EP, PUR, AY	3-4	360	✓	✓	✓	✓
C5.08	EP, PUR, ESI	Zn (R)	1	60 to 80	EP, PUR, AY	3-4	320	✓	✓	✓	✓

NOTE1 EP: Epoxy, PUR: Polyurethane, ESI: Ethyl silicate*1, AY: Acrylic, Zn(R): Zinc-rich primer, Misc.: All other categories of primer
NOTE2 In addition to polyurethane technology, other coating technologies may be suitable, e.g. polysiloxanes, polyaspartic **and fluoropolymer [Fluoroethylene/vinyl ether co-polymer(FEVE)]**.

Category of Atmospheric Enviroments

C1	Very low corrosivity
C2	Low corrosivity
C3	Medium corrosivity
C4	High corrosivity
C5	Very high corrosivity

Durabillity Levels

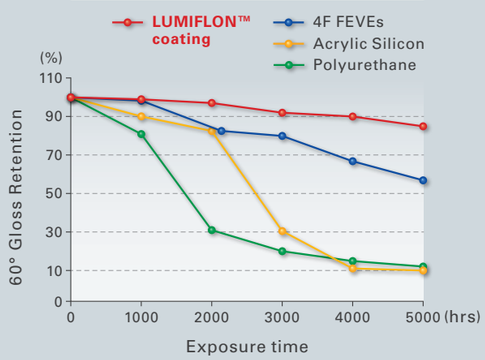
Durabillity type	Terms
Low (l)	Up to 7 years
Medium (m)	7 years to 15 years
High (h)	15 years to 25 years
Very high (vh)	More than 25 years

WEATHER ABILITY

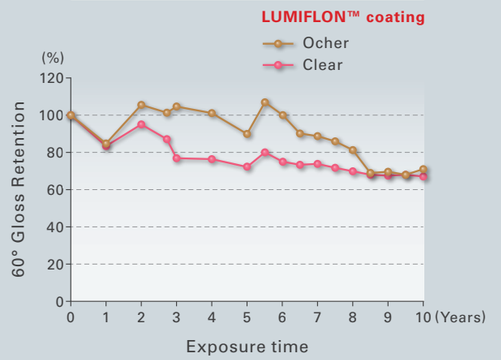
Weatherability data

LUMIFLON™ shows excellent weatherability compared to acrylics and polyurethanes and also outperforms other fluoropolymer resins.

Sunshine weather meter test



Natural exposure test (Florida)

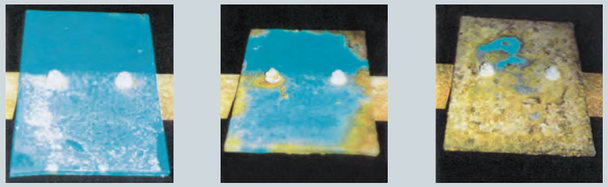


PERFORMANCE

Exposure test

Duration: 5 years
Location: Ocean shore
New/Repaint: Repaint
Paint system: Heavy duty

Upper half of the plates are shown after wiping.
Bottom half of the plates are covered with salt.



LUMIFLON™ coating: Good appearance

Chlorinated rubber coating: Rust at the corners

Alkyd coating: Covered with rust

Erosion of Coating Over Time

In the fluoropolymer coating using LUMIFLON™, little wear was observed over the 15 year period. In contrast, wear of 2μm per year was observed in the polyurethane coating.

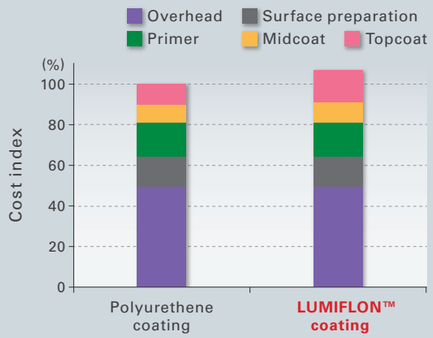
LUMIFLON™ coating (after 15 years)

Polyurethane coating (after 15 years)

LIFE CYCLE COST

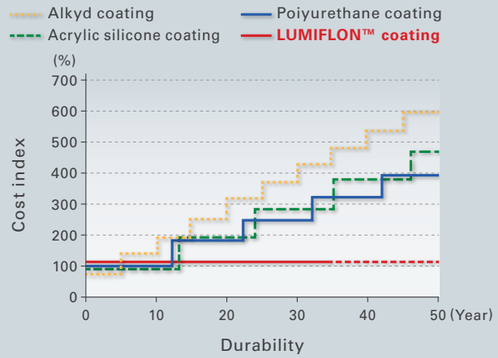
Coating cost comparison

Because LUMIFLON™ topcoats typically utilize the same surface preparation, primers and midcoats as traditional polyurethanes, the initial cost of a fluoropolymer system is only slightly higher than a more traditional polyurethane system.



Life cycle cost (LCC) composition

LUMIFLON™ based coatings offer long-term economic benefits as they maintain their appearance significantly longer than traditional systems eliminating one or more repainting costs as well as reducing maintenance costs.



ACTUAL PROJECT

Tokiwa Bridge

[Photo taken]
30 years after painting
(November 2016)

[Painted]
August 1986

[Environment]
Mountainous area

[New/re-paint]
Repainting

[Original Coating]
Chlorinated rubber

[Painting Specification]
Surface preparation : St 3 (ISO)
Primer : Modified epoxy coatings
Intermediate and top coats:
LUMIFLON™-based fluorourethane

- **Gloss retention is almost 100%**
- **Frequent use of road salt for de-icing in winter**
- **Scenery can be seen reflected in the high gloss of fluorourethane coating.**

Daiichi Mukaiyama Bridge

[Photo taken]
29years after painting
(November 2016)

[Painted]
August 1987 (Fluoropolymer coatings)
August 1986 (Polyester coationg)

[Environment]
Mountainous area

[New/re-paint]
New Construction

[Painting Specification]
Surface preparation : St 2 1/2 (ISO)
Middle coat : Epoxy coating
Intermediate and top coats :
LUMIFLON™-based fluorourethane

Surface preparation : St 2 1/2 (ISO)
Primer : Zinc-based anticorrosive coating
Intermediate and top coats : Alkyd coating

- **The LUMIFLON™ based coating shows excellent gloss retention and no chalking.**
- **Dirt is visible in the photograph but coating quality is not affected.**

- **The Alkyd coating were excessively deteriorated after only 16 years.**

LUMIFLON™ Projects for Heavy duty

The superior durability and weatherability of LUMIFLON™ FEVE resin based coatings are recognized and proven by the projects using these coatings all over the world LUMIFLON™ will continue to protect and maintain the beauty of structures from the deserts of North Africa to the wet and rainy coasts of the Gulf of Mexico and even to the mountains of Japan.

EUROPE

Adige Bridge (Italy)

Expo Bridge (Italy)

Gleisbogen Bridge (Swiss)

Finzels Reach Bridge (England)

CHINA

Lhasa River Bridge (Lhasa City)

Pingtan Bridge (Pingtan, Fujian)

Guanting Railway Grand Bridge (Bejing)

Skydance bridge (Oklahoma) Photo:Tim Hursley

Boynton Inlet Bridge (Florida)

AMERICA

Topeka Boulevard Bridge (Kansas)

ASIA

Nhat Tan Bridge (Vietnam)

Liufang Bridge (Taiwan)

Aura Boulevard Bridge (Australia)

Yeongjung Bridge (Korea)

JAPAN

Tokyo Gate Bridge (Tokyo)

Akashi Kaikyo Bridge (Hyogo)

Rainbow Bridge (Tokyo)

TOKYO SKYTREE™ (Tokyo)