

Coalescents

Enabling Film Formation
and Performance



Indovinya is the global specialty chemical and surfactants division of Indorama Ventures. We are the leading EO producer in the Americas, with operations across 10 countries and 15 manufacturing locations.

Indovinya is rooted in chemistry, powered by people, driven by innovation, and guided by sustainability and community impact.

#1
Non-ionic surfactants producer in the Americas

#1
Supplier of Home Care Ingredients in the Americas

#1
Leading supplier in crop solutions in the Americas

Footprint



- 15** Industrial Units
- 7** Global R&D Centers
- Presence in **10** Countries
- Approximately **3,000** Employees

Industries Units R&D and Tech Centers

Coalescents for Waterborne Coatings:

Enabling Film Formation and Performance

Coalescents are vital in waterborne coatings, enabling uniform film formation during drying by softening polymer particles. Their efficiency affects key properties like MFFT, gloss, hardness, scrub and blocking resistance. Indorama Ventures offers tailored coalescent solutions through its ULTRAFILM® portfolio, featuring low/zero-VOC

options, renewable content, and compatibility with various latex chemistries. Beyond standard performance tests, the company provides custom development using digital tools like HSP and HTE to optimize formulations and predict outcomes. With a science-driven approach, Indorama is a strategic partner for high-performance, durable coatings.

Coalescents for Water-based Coatings

Product	Boiling Point (°C)	Hansen Solubility Parameter			Features and applications
		Delta D (MPa ^{1/2})	Delta P (MPa ^{1/2})	Delta H (MPa ^{1/2})	
ULTRAFILM® 260 LV	>250	18.4	7.1	11.4	<ul style="list-style-type: none"> • Market leader in Brazil • Odorless • High film forming efficiency • Widely recognized performance
ULTRAFILM® 2770	>270	17.8	5.7	7.5	<ul style="list-style-type: none"> • Broad compatibility with different types of emulsion polymers • Low odor • High efficiency for reducing the MFFT • Easily incorporated even at high temperatures
ULTRAFILM® 5000	>280	15.8	3.5	4.6	<ul style="list-style-type: none"> • Renewable product content • Reduces water sensitivity • High efficiency for reducing the MFFT • Improves hardness evolution: lower dirt pick-up • Excellent performance on final paints properties
ULTRAFILM® 5400	>400	16.9	4.3	7.3	<ul style="list-style-type: none"> • Zero VOC to different normatives worldwide, including ASTM D6886-03 and SCAQMD Method 313 • Low odor • High film forming efficiency • High compatible with different types of emulsion polymers and easy to incorporate.

TMIB (2,2,4-trimethyl-1,3-pentanediol monoisobutyrate): Boiling Point 255°C; Hansen Solubility Parameters - Delta D 15.1 / Delta P 6.1 / Delta H 9.8

TGBE (Triethylene glycol bis(2-ethylhexanoate)): Boiling Point 418°C; Hansen Solubility Parameters - Delta D 16.1 / Delta P 3.3 / Delta H 4.4

ULTRAFILM® 2770

ULTRAFILM® 2770 is a cost effective, coalescing agent. The product has a broad compatibility with different types of emulsion polymers and can be easily incorporated even at high temperatures. Due its high efficiency, a lower demand in relation to other coalescents can be used for achieving the target MFFT.

Benefits

- Low odor in relation to TMIB
- Compatible with different emulsion polymers (Styrene-Acrylic, Vinyl-Acrylic and Pure Acrylic)
- Ease for incorporation on paints and emulsion polymers. The product can be incorporated on emulsion polymers at high temperatures
- High efficiency for reducing the MFFT of different emulsion polymers – lower demand in relation to TMIB
- Easy for replacing TMIB, with no significant formulation adjustments
- Excellent performance on final paints properties

Features

- Low viscosity clear liquid
- Boiling point >270°C
- High efficiency for reducing MFFT

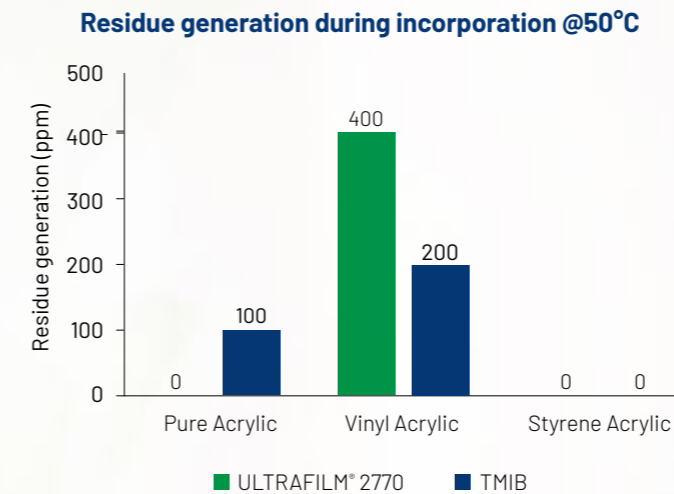
Performance Tests

Residue Generation



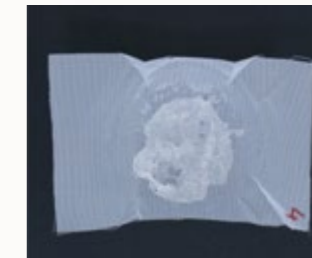
Measures the amount of unwanted residue generated during the coalescent incorporation on emulsion polymers at high temperatures. Lower residue levels contribute to cleaner, clearer finishes, especially in transparent or semi-gloss coatings.

Process incorporation in different latexes at 50 °C



Vinyl Acrylic emulsion polymer

Coalescing agent with poor compatibility



Poor compatibility; residue generation = 13200 ppm

ULTRAFILM® 2770



Excellent compatibility; residue generation = 400 ppm

Due to its chemical composition, **ULTRAFILM® 2770** is highly compatible with different emulsion polymers and can be easily incorporated in the paint formulation or in the emulsion polymer at room or high temperatures.

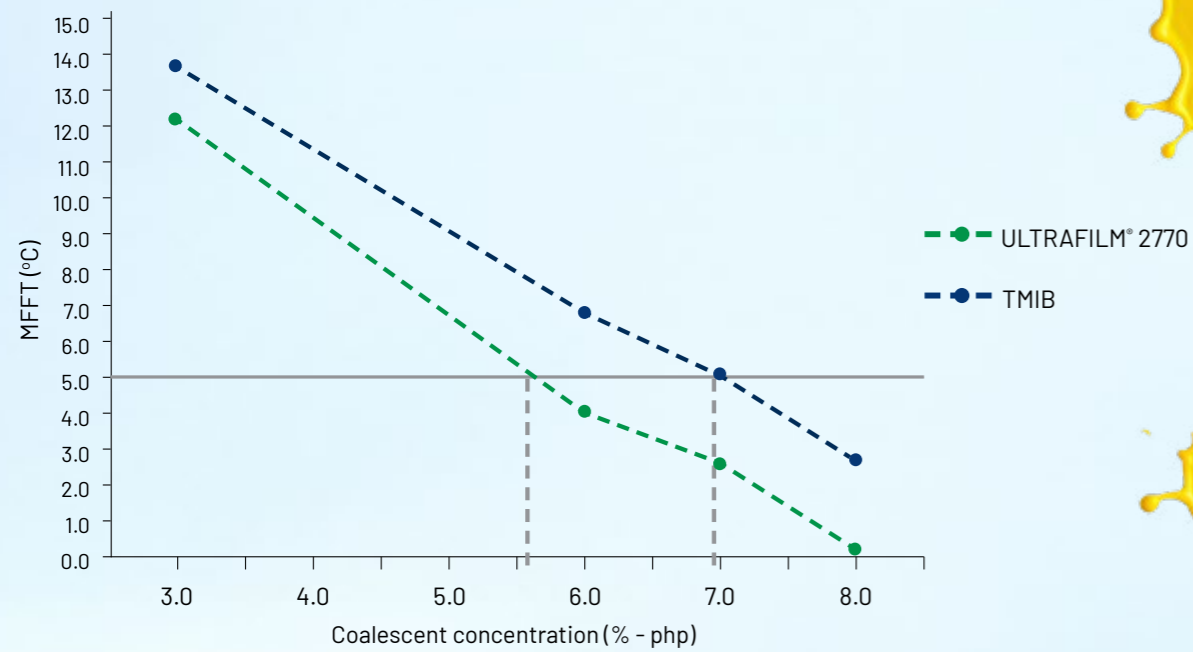
Performance Tests

Minimum Film Formation Temperature (MFFT-ASTM D2354)

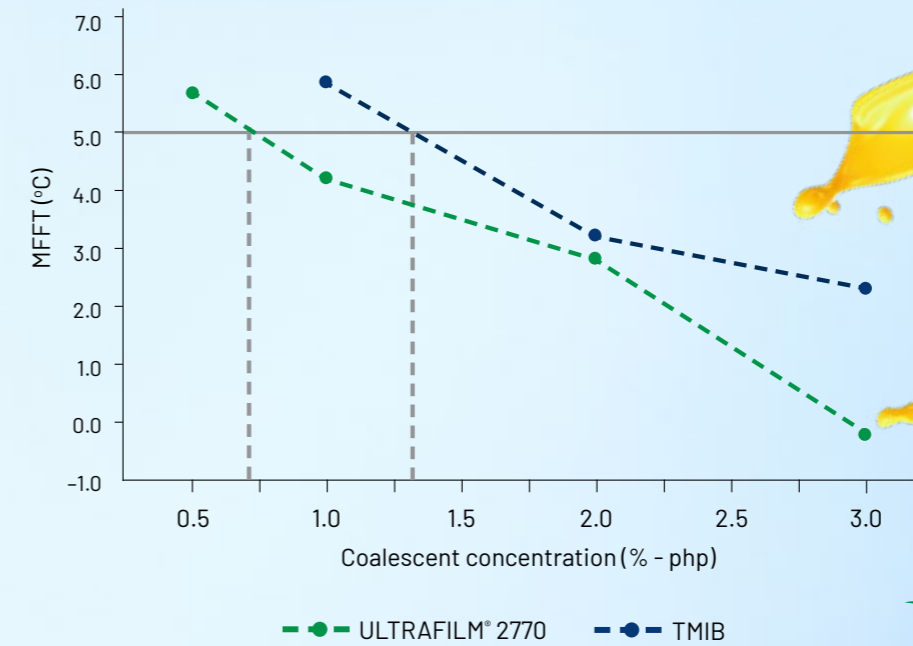


Indicates the lowest temperature at which a continuous film can form. A lower MFFT allows for proper film formation even in cooler conditions, expanding the application window.

STYRENE ACRYLIC LATEX, $T_g \sim 30^\circ\text{C}$, MFFT $\sim 22^\circ\text{C}$



VINYL ACRYLIC LATEX, $T_g \sim 17^\circ\text{C}$, MFFT $\sim 12^\circ\text{C}$



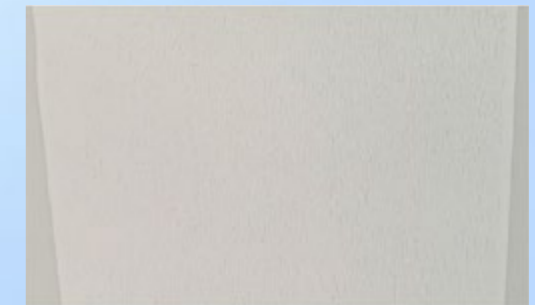
Due to its compatibility and ease for incorporation, **ULTRAFILM® 2770** is highly effective for reducing the minimum film formation temperature (MFFT) of different emulsion polymers.

Low Temperature Film Formation - ASTM D7306-7

ULTRAFILM® 2770 @6.0% php

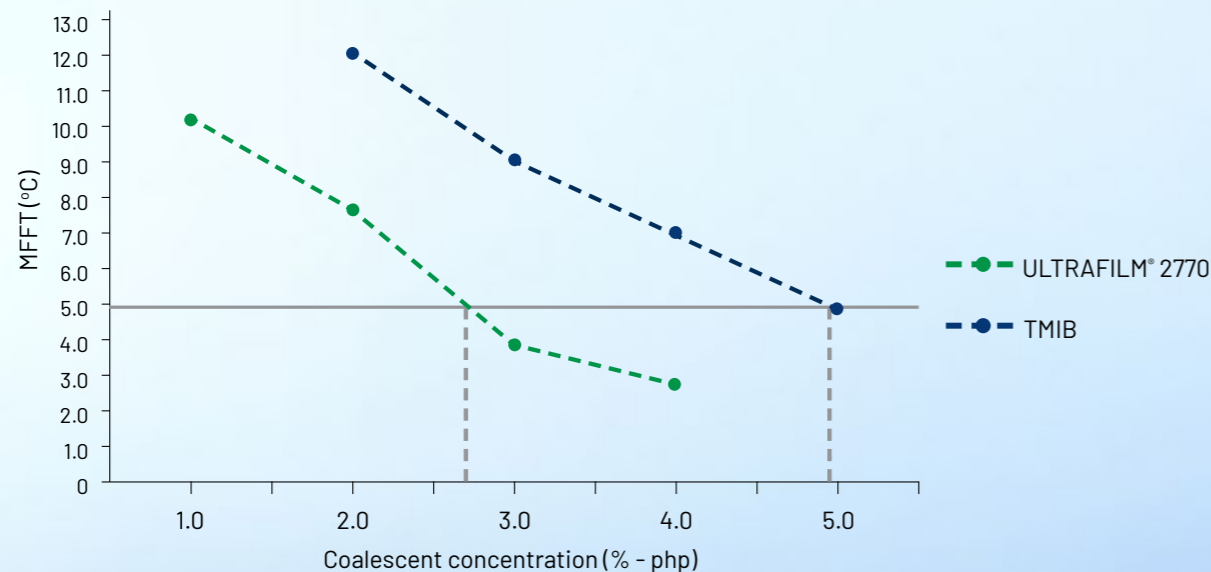


TMIB @6.0% php



The images refer to the paint films (SEMI-GLOSS EXTERIOR ACRYLIC PAINT) formed on the porous area of the substrate after 18 hours of curing at 4 °C

PURE ACRYLIC LATEX, $T_g \sim 29^\circ\text{C}$, MFFT $\sim 20^\circ\text{C}$



ULTRAFILM® 2770 requires a lower dosage in relation to TMIB for ensuring film formation under low temperatures.

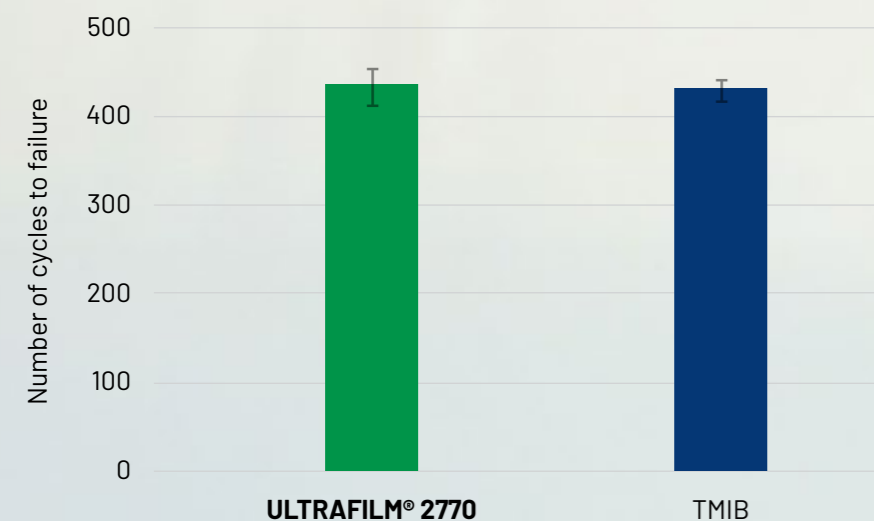
Performance Tests

Styrene Acrylic Economic Paint

Formulation	O1LBR – Styrene Acrylic Economic Paint
Emulsion polymer	Styrene Acrylic, Tg ~ 30°C, MFFT ~ 22°C
Emulsion Polymer content	8.0%
PVC	~ 87%
Coalescent content	0.40% (10.0% php)

Wet scrub resistance without abrasive paste – ABNT NBR 15378

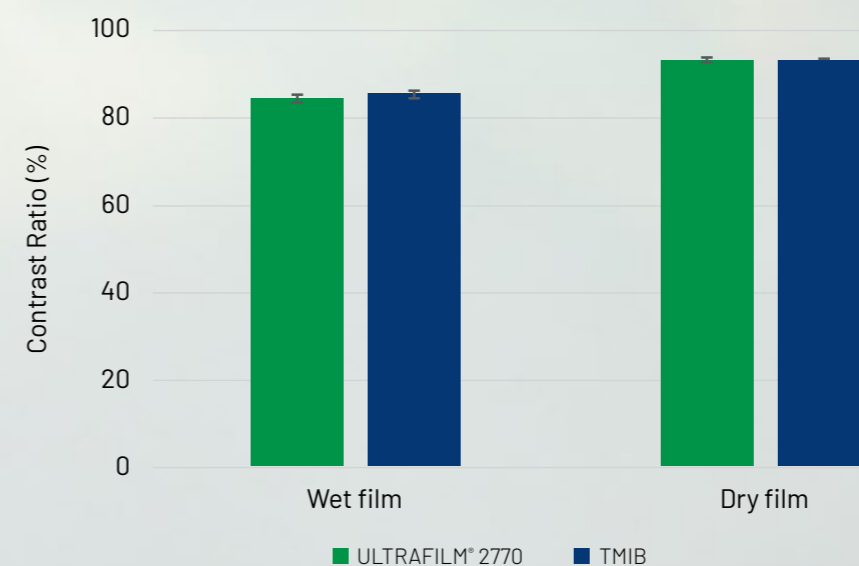
Styrene Acrylic Economic Paint



Wet hiding power – ABNT NBR 14943 & Dry hiding power – ABNT NBR 15314



Hiding power tests evaluate a coating's ability to cover the substrate, both during application and after drying. The **wet hiding power test (ABNT NBR 14943)** measures how well the paint covers immediately after application, while the **dry hiding power test (ABNT NBR 15314)** assesses final opacity once the film has fully formed.



ULTRAFILM® 2770 generates films with good wet scrub resistance and hiding power, compared to TMIB.

Performance Tests

Styrene Acrylic Standard Matte Paint

Formulation	02LBR - Styrene Acrylic Standard Matte Paint
Emulsion polymer	Styrene Acrylic, Tg ~ 30°C, MFFT ~ 22°C
Emulsion Polymer content	14.0%
PVC	~ 78%
Coalescent content	0.85% (12.0% php)



Performance Tests

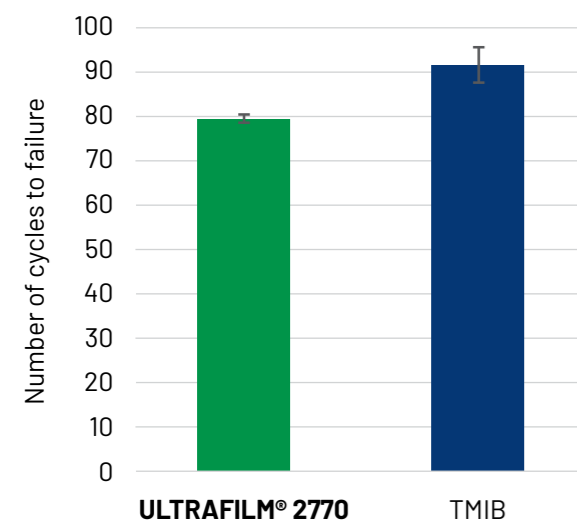
Styrene Acrylic Premium Matte Paint

Formulation	03LBR - Styrene Acrylic Premium Matte Paint
Emulsion polymer	Styrene Acrylic, Tg ~ 30°C, MFFT ~ 22°C
Emulsion Polymer content	25.0%
PVC	~ 54%
Coalescent content	1.10% (9.0% php)



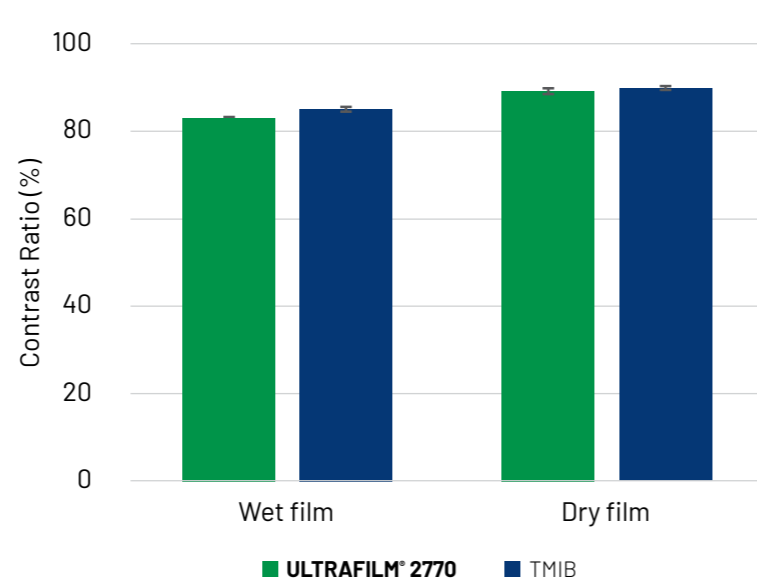
Wet scrub resistance - ABNT NBR 14940

Styrene Acrylic Standard Matte Paint



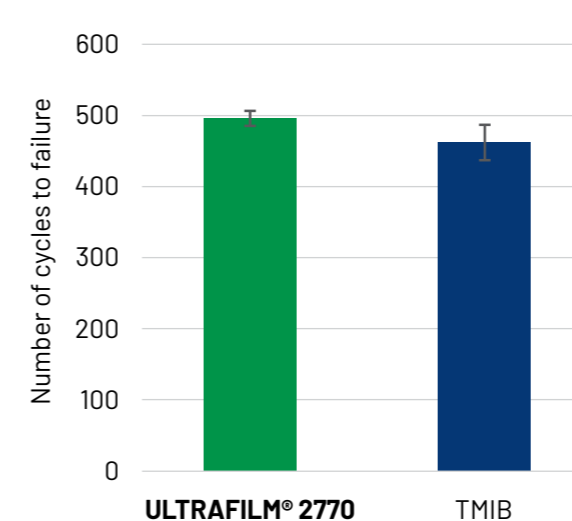
Wet hiding power - ABNT NBR 14943 & Dry hiding power - ABNT NBR 15314

Styrene Acrylic Standard Matte Paint



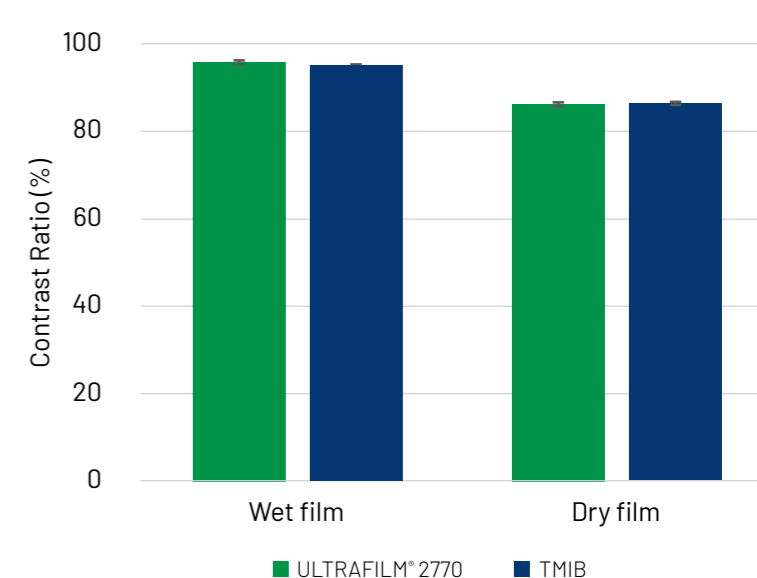
Wet scrub resistance - ABNT NBR 14940

Styrene Acrylic Standard Matte Paint



Wet hiding power - ABNT NBR 14943 & Dry hiding power - ABNT NBR 15314

Styrene Acrylic Premium Matte Paint



ULTRAFILM® 2770 generates films with good wet scrub resistance and hiding power, compared to TMIB.

Performance Tests

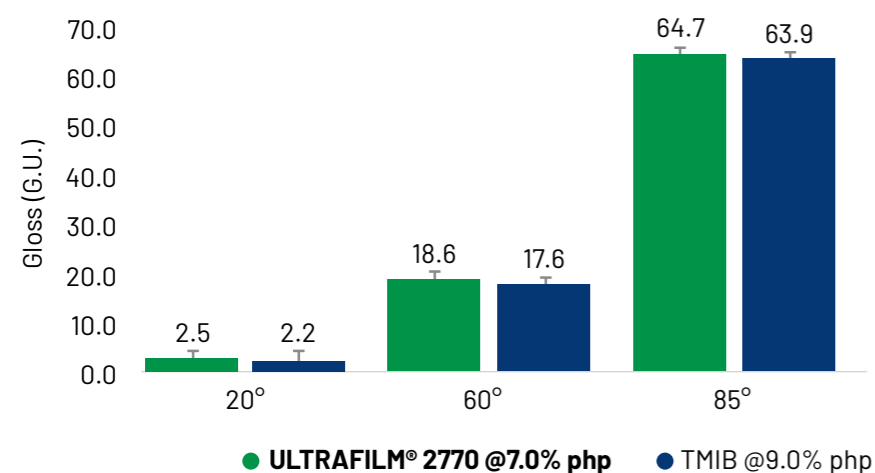
Semi-gloss exterior Acrylic paint

Formulation	05LBR - Acrylic Semi-gloss
Emulsion polymer	Pure Acrylic. Tg~29°C.MFFT~20°C
Emulsion polymer content	35%
PVC	32%
Coalescent content	1.20% (7% php) - 1.60% (9% php)

Gloss Evaluation



Assesses the smoothness and reflectivity of the dried film. A consistent gloss level enhances visual appeal and reflects proper coalescence and surface uniformity.



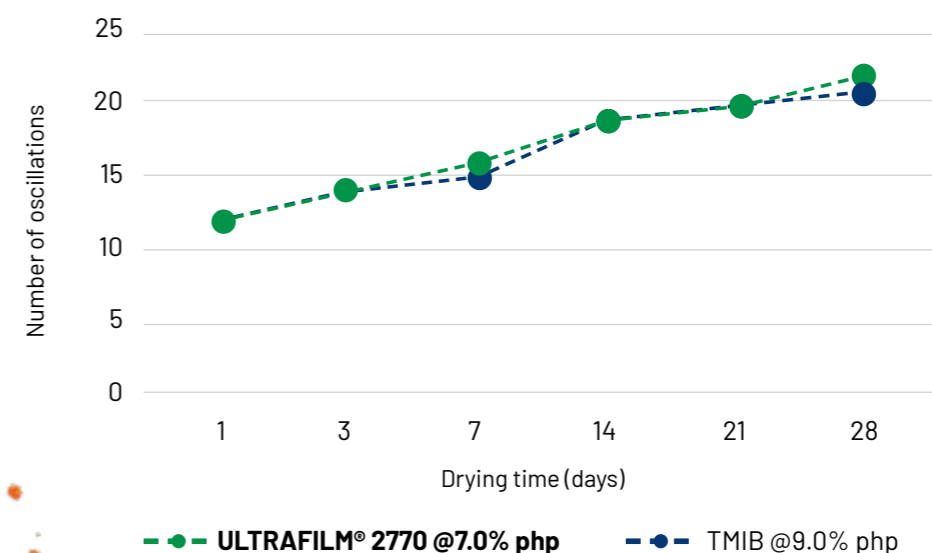
Substrate: Glass
Wet film thickness: 150 µm
Drying conditions: 24 hours at 25±2 °C and 55±5 % RH
Equipment: Rhopoint, model IQ

ULTRAFILM® 2770 develops higher values of gloss even with a 28% dosage reduction in the paint formulation in relation to TMIB

König surface hardness evolution - ASTM D4366-16, Method A



Tracks the increase in surface hardness over time. Higher hardness improves resistance to scratches and wear, contributing to long-term durability.



Substrate: Glass
Wet film thickness: 150 µm
Drying conditions: 24 hours at 25±2 °C and 55±5 % RH
Drying times for evaluation: 1, 3, 7, 14, 21 and 28 days

ULTRAFILM® 2770 presents a very similar performance in terms of surface hardness evolution in relation to TMIB

Performance Tests

Blocking resistance - ASTM D4946-89



Evaluates the tendency of painted surfaces to stick together when pressed. High blocking resistance is crucial for usability in doors, windows, and furniture applications.

Substrate: Leneta 3B
Wet film thickness: 150 µm
Drying conditions: 7 days at 25±2 °C and 55±5 %RH

Sample	Blocking resistance numerical rating	Type of separation	Performance
ULTRAFILM® 2770 @7.0% php	3	5 to 25% seal	Poor
TMIB @9.0% php	2	25 to 50% seal	Poor

Blocking Resistance Numerical Ratings	Type of Separation	Performance
10	no tack	perfect
9	trace tack	excellent
8	very slight tack	very good
7	very slight to slight tack	good to very good
6	slight tack	good
5	moderate tack	fair
4	very tacky; no seal	poor to fair
3	5 to 25 % seal	poor
2	25 to 50 % seal	poor
1	50 to 75 % seal	very poor
0	75 to 100 % seal	very poor



Accelerated Weathering Resistance



Simulates long-term exposure to sunlight, moisture, and temperature changes. Ensures that exterior coatings maintain their performance and appearance over time.



Substrate: Aluminum
Wet film thickness: 150 µm
Drying conditions: 7 days at 25 +/- 2 °C and 55 +/- 5% RH
Equipment: QUV-Spray
Lamp: UV-A, irradiance 0.77 W.m⁻² nm⁻¹
Cycles: 8 hours of UV-lamp at 60°C and 4 hours of condensation at 50 °C
Exposure time: 600 hours

Sample	ΔE	Gloss retention (%)	Cracking	Calcination	Blistering classification - ASTM D714
ULTRAFILM® 2770 @7.0% php	0.08 ± 0.03	49.7±1.0	Not observed	Not observed	No blistering
TMIB @9.0% php	0.31 ± 0.22	50.9 ± 2.3	Not observed	Not observed	No blistering



ULTRAFILM® 2770 @7.0% php TMIB @9.0% php

Specimens after tests completion



Due to the lower coalescent demand in the paint formulation, **ULTRAFILM® 2770** is suitable to be used when improving blocking resistance is necessary

Even with a 28% dosage reduction, **ULTRAFILM® 2770** ensures a good film formation and weathering resistance for the paint

Performance Tests

Dirt Pick-Up Resistance - UNI 10792



Assesses how easily dirt adheres to the paint surface. Improved resistance helps maintain a clean look and reduces maintenance for exterior applications.

Substrate: Leneta P123-10N
Wet film thickness: 200 µm
Drying conditions: 28 days at 25±2 °C and 55±5 % RH
Specimen for test: 10 x 10 cm
Dirt material: 1% dispersion in distilled water of a carbon black pigment concentrate containing 35% dry material
Exposure procedure: immersion on dirt material (approximately halfway) for 30 seconds
Cleaning procedure: immediately after exposure, rinse with water for 10 seconds
Color measurement: after 24h, on the non- exposed and exposed areas, for the L axis

Sample	ΔL	Classification
ULTRAFILM® 2770 @7.0% php	0.03	Very low
TMIB @9.0% php	0.02	Very low

Classification according to UNI 10792

Classification	ΔL
Very low	≤ 3
Low	3 < ΔL ≤ 9
High	9 < ΔL ≤ 15
Very high	> 15

Specimens after tests completion

ULTRAFILM® 2770 @7.0% php TMIB @9.0% php



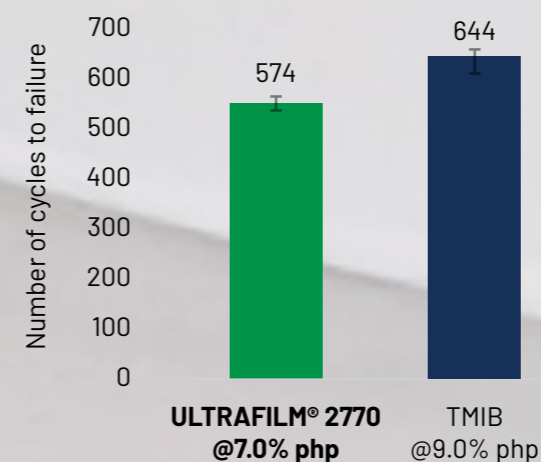
The use of **ULTRAFILM® 2770** is suitable for the development of paints with good dirt pick-up resistance



Wet scrub resistance - ASTM D2486-17, Method A



Demonstrates the coating's ability to withstand repeated cleaning without degrading. Essential for maintaining durability and appearance in high-traffic interior areas.



Mechanical properties



Coalescent dosage



Surface properties

Even with a high dosage reduction (28%), the use of **ULTRAFILM® 2770** generates films with good wet scrub resistance



Performance Tests

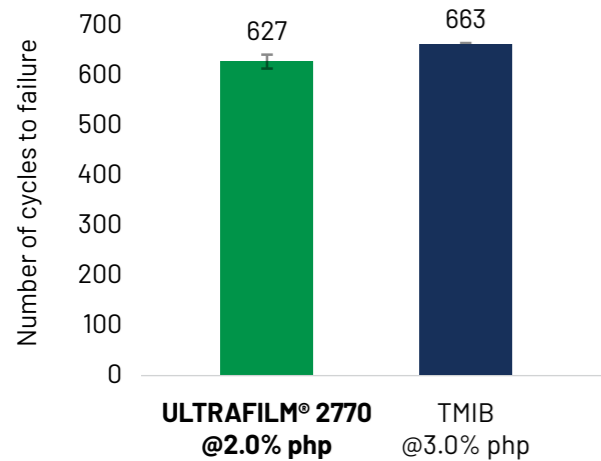
Flat interior vinyl acrylic paint

Formulation	01LUS - Interior Vinyl Acrylic Flat Paint
Emulsion polymer	Vinyl Acrylic, Tg ~17°C, MFFT ~12°C
Emulsion polymer content	28%
PVC	45%
Coalescent content	0.33% (2% php) - 0.47% (3% php)

Wet scrub resistance - ASTM D2486-17, Method A



Demonstrates the coating's ability to withstand repeated cleaning without degrading. Essential for maintaining durability and appearance in high-traffic interior areas.



Mechanical properties



Coalescent dosage



Surface properties

Even with a high dosage reduction (about 33%), the use of **ULTRAFILM® 2770** generates paint films with excellent wet scrub resistance

Washability (Stain Resistance) - ASTM D4828-94 (Liquid detergent and mechanical method)



Indicates how easily stains and marks can be removed from the surface. A key property for interior paints used in kitchens, bathrooms, and children's rooms.

	Stain removal rate							
	Pencil	Crayon	Lipstick	Pen	Permanent marker	Coffee	Ketchup	Grape juice
ULTRAFILM® 2770 @2.0% php	10	5	3	0	0	5	10	3
TMIB @3.0% php	10	5	3	0	0	7	10	3

Classification according to ASTM D4828-94

Classification	Description
0	No change from original intensity (depth) of soil or stain
3	Slight change from original, but readily visible
5	Moderate change from original, slightly visible
7	Large change from original, barely visible
10	All soil and stain removed

ULTRAFILM® 2770 presents a very similar performance in terms of washability in relation to TMIB



ULTRAFILM® 260 LV

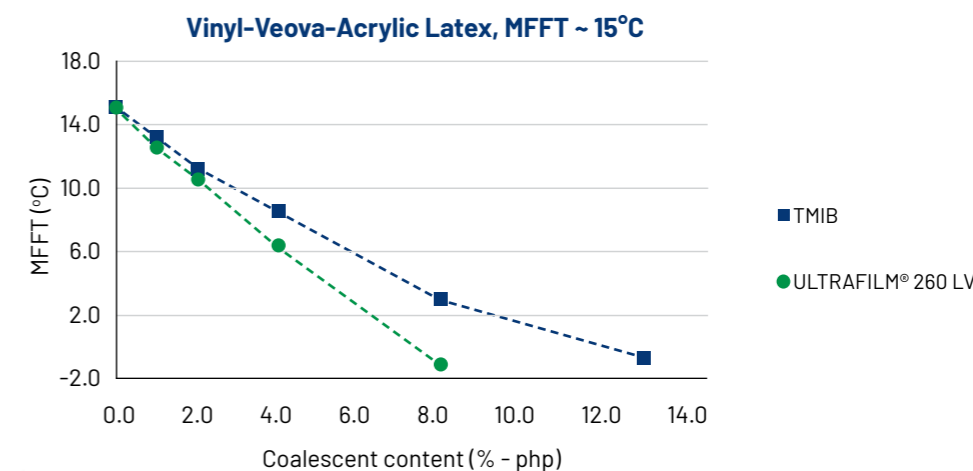
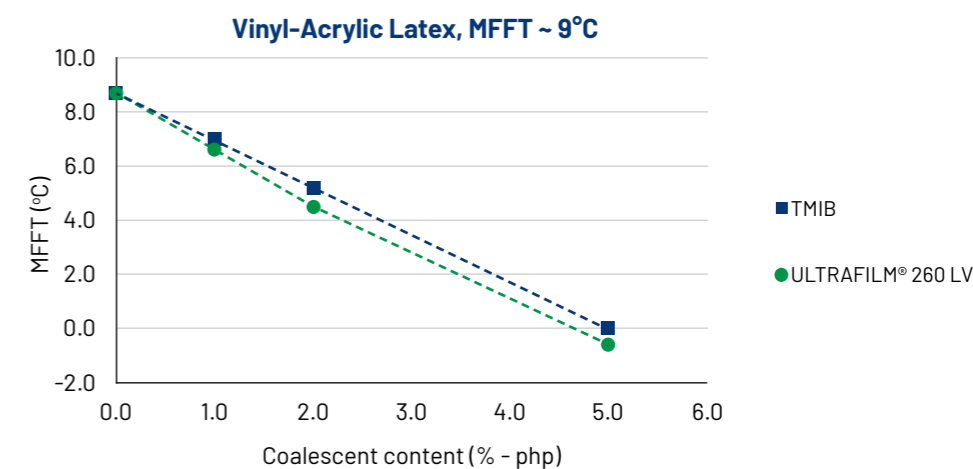
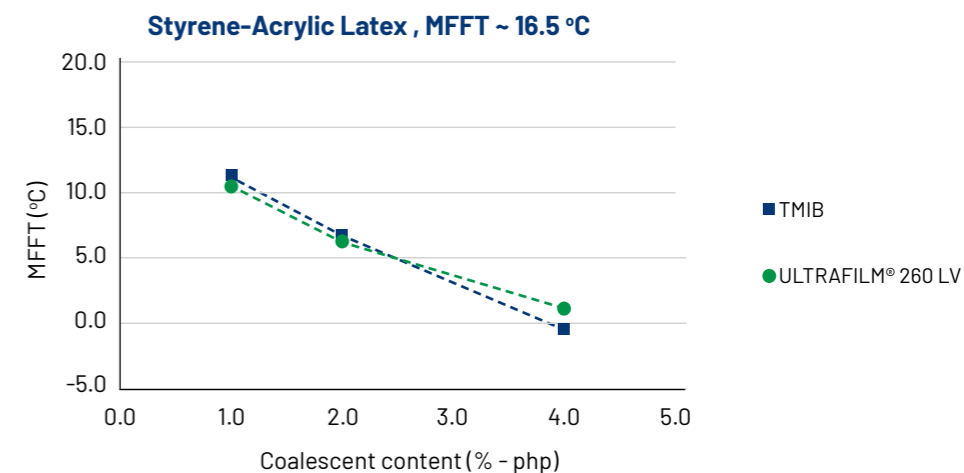
- Market leader in Brazil with local production
- Odorless
- Hydrolytical stability
- Effective for reducing MFFT of different latexes
- Paints with high scrub resistance
- Easy to use in paint manufacturing

Performance Tests

Minimum Film Formation Temperature (MFFT-ASTM D2354)



Indicates the lowest temperature at which a continuous film can form. A lower MFFT allows for proper film formation even in cooler conditions, expanding the application window.



Performance Tests

Paint performance

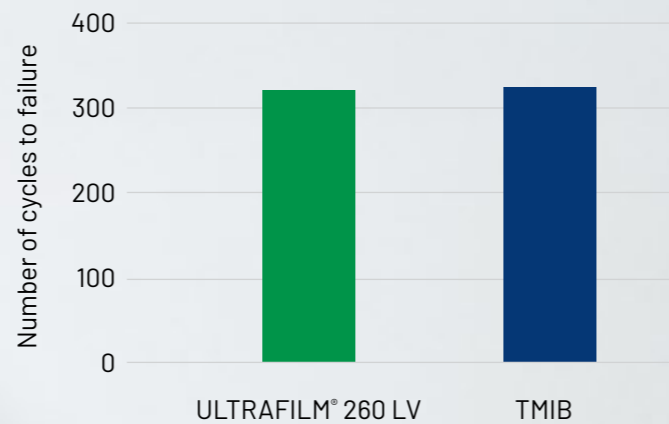
Evaluation on a styrene acrylic Premium Semi-gloss paint

Formulation	Styrene Acrylic Semi-gloss
Emulsion polymer	MFFT ~16.5 °C
Emulsion polymer content	35%
PVC	30%
Coalescent content	2.0% (11.4% php)

Wet scrub resistance - ABNT NBR 14940 Styrene Acrylic Premium Semi-gloss paint



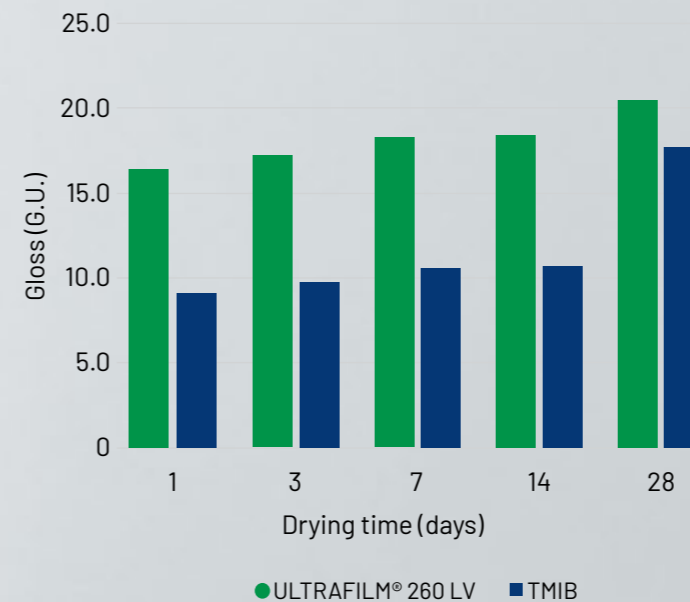
Demonstrates the coating's ability to withstand repeated cleaning without degrading. Essential for maintaining durability and appearance in high-traffic interior areas.



Gloss Evaluation - ABNT NBR 15299 Styrene Acrylic Premium Semi-gloss paint



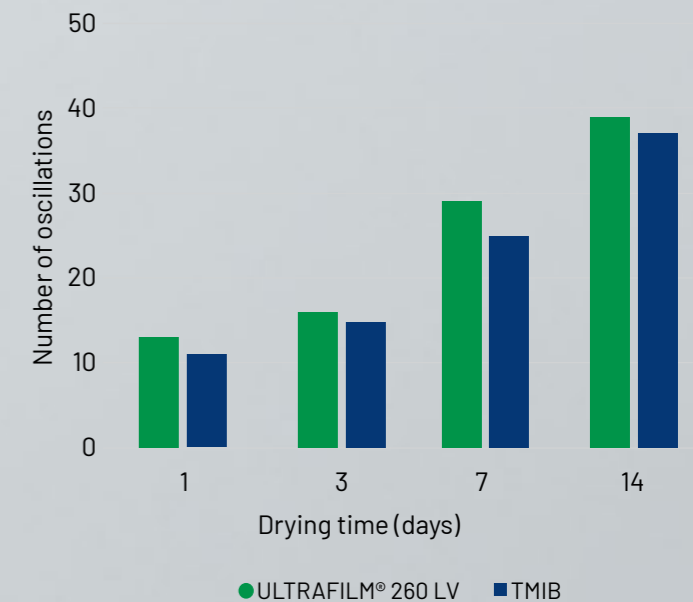
Assesses the smoothness and reflectivity of the dried film. A consistent gloss level enhances visual appeal and reflects proper coalescence and surface uniformity.



König surface hardness evolution - ABNT NBR 14946 Styrene Acrylic Premium Semi-gloss paint



König surface hardness evolution tracks the increase in surface hardness over time. Higher hardness improves resistance to scratches and wear, contributing to long-term durability.



ULTRAFILM® 5000

Innovative coalescent with superior performance and a sustainable profile.

ULTRAFILM® 5000 is a patented technology developed to deliver superior film-forming performance, with emphasis on surface smoothness, water resistance, and reduced dirt pickup. It contains renewable content. Compatible with various types of latex, it is ideal for premium formulations with a sustainable appeal.

Benefits

- Better film formation
- Reduces water sensitivity
- Improves hardness evolution: lower dirt pick-up
- Films with low blistering
- Low leaching

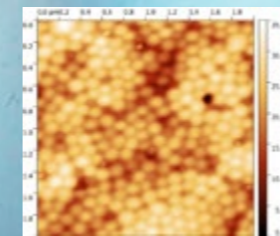
Features

- Proprietary Ester
- Renewable product content
- Boiling point >280°C
- Efficient to reduce MFFT
- Package: Sample, Drum, Bulk

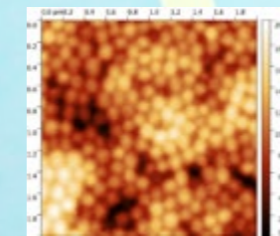


Performance Tests

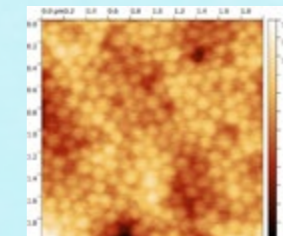
FILM FORMATION



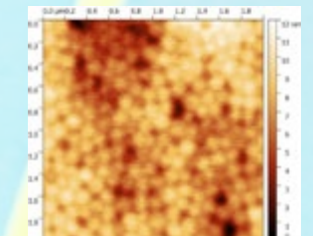
ACRYLIC LATEX



ACRYLIC LATEX + 6% PHP OF TMIB



ACRYLIC LATEX + 6% php OF TGBE



ACRYLIC LATEX + 6% php OF ULTRAFILM® 5000

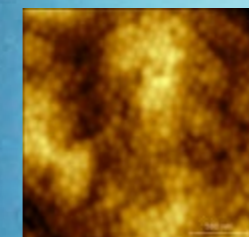
Instrumental test: AFM (Atomic Force Microscopy).

Tested latex: Pure Acrylic (MFFT ~ 17 °C | Tg ~ 29 °C).

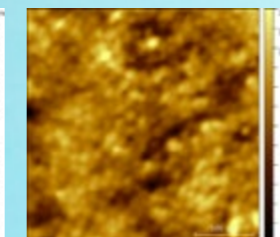
Test condition: Film cast on Leneta chart and dried @ 25 ± 5 °C, 60% R.H. for 7 days.

- Better coalescence: reduced particle's domains
- Lower average height – smoother film

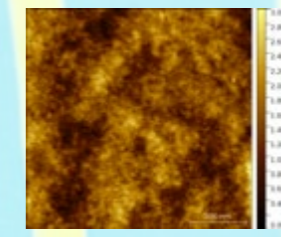
FILM FORMATION



STYRENE-ACRYLIC LATEX



STYRENE-ACRYLIC LATEX + 10% php OF TMIB



STYRENE-ACRYLIC LATEX + 10% php OF ULTRAFILM® 5000

Instrumental test: AFM (Atomic Force Microscopy).

Tested latex: Styrene-Acrylic (MFFT ~ 21 °C | Tg ~ 28 °C).

Test condition: Film cast on Leneta chart and dried @ 25 ± 5 °C, 60% R.H. for 7 days.

- Particle domains no longer perceivable – maximum entanglement of polymeric chains
- Lower average height – smoother film

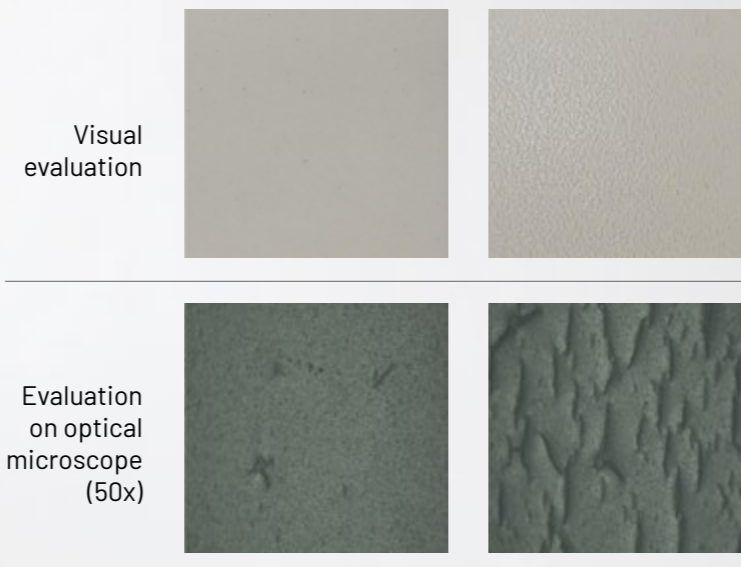
Performance Tests

Low Temperature Film Formation (LTF) - ASTM D7306-7



Reflects the ability of the coalescent to enable film formation at low ambient temperatures. Critical for ensuring reliable performance in colder climates.

ULTRAFILM® 5000 @8.0% php **TMIB @8.0% php**



Tested paint: Pure acrylic semi-gloss paint, PVC ~ 32%, Latex content ~ 35% and coalescent content ~ 1.4%.

At the same dosage, paints formulated with **ULTRAFILM® 5000** present better film formation under extreme conditions.

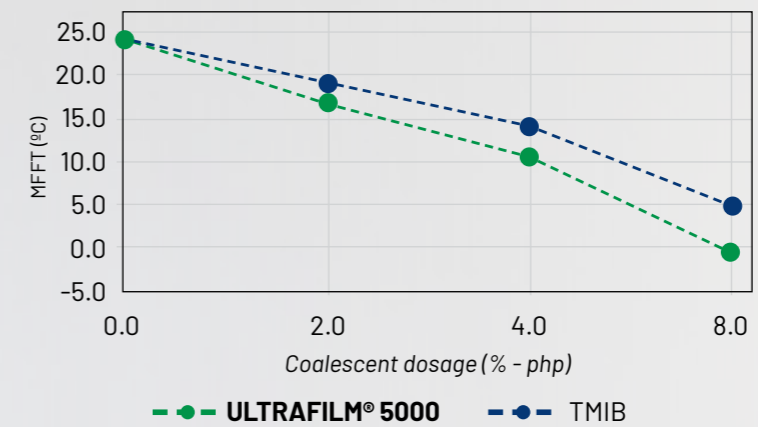
Performance Tests

MFFT reduction efficiency - ASTM D2354

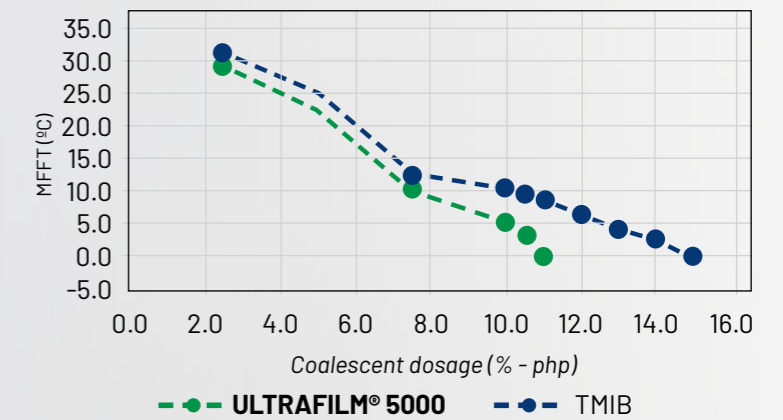


Indicates the lowest temperature at which a continuous film can form. A lower MFFT allows for proper film formation even in cooler conditions, expanding the application window.

Styrene acrylic latex, T_g~30°C, MFFT~23°C



Modified acrylic, T_g~50°C, MFFT~45°C



Test condition: Performed according to ASTM D2354

ULTRAFILM® 5000 is highly efficient for reducing MFFT of different latexes

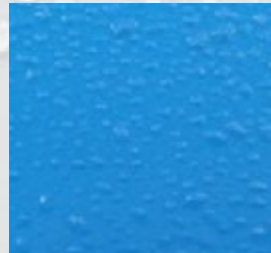
Performance Tests

Water Absorption



Measures the amount of water absorbed by the dried film. Lower absorption enhances water resistance, preventing blistering, swelling, and degradation.

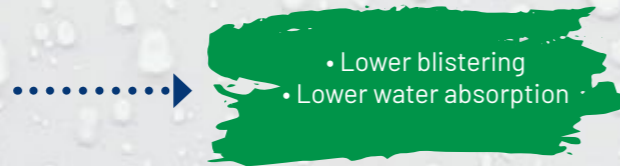
STYRENE-ACRYLIC
PAINT +10% php OF
TMIB



STYRENE-ACRYLIC
PAINT +10% php OF
ULTRAFILM® 5000



Tested latex: Styrene-Acrylic (MFFT ~ 21 °C | Tg ~ 28 °C).
Test condition: 55% PVC blue paint cast on Leneta chart and dried @ 5 ± 2 °C, 60% R.H. for 1 day and immersed in distilled water for 4h.

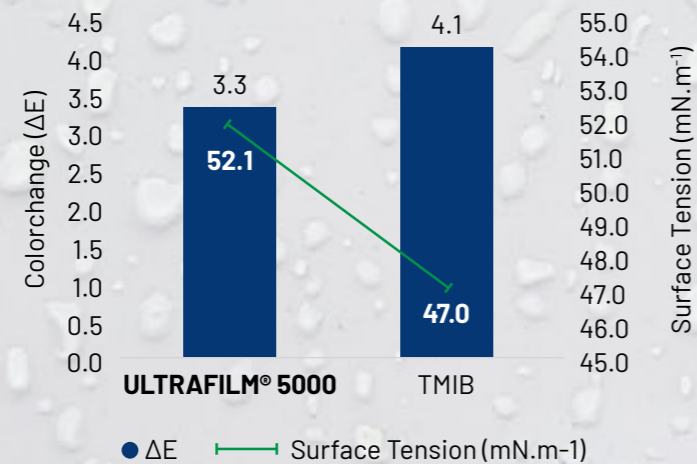


Leaching Resistance



Assesses the tendency of water-soluble components to migrate from the paint film when exposed to moisture. Evaluated through color change and water surface tension measurements, strong leaching resistance ensures better appearance retention, minimizes environmental impact, and enhances performance in humid or rainy conditions.

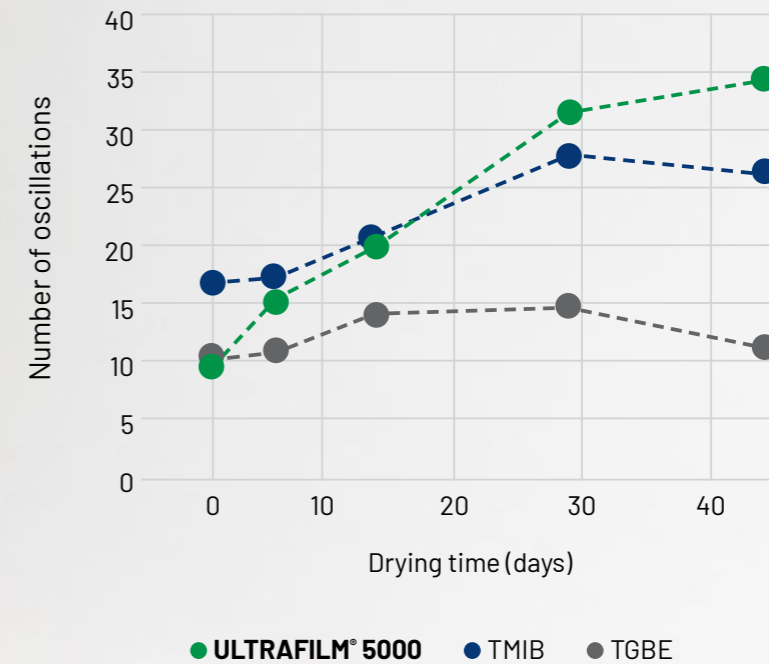
COLOR CHANGE AND WATER SURFACE TENSION



König Surface Hardness Evolution - ASTM D4366



Tracks the increase in surface hardness over time. Higher hardness improves resistance to scratches and wear, contributing to long-term durability.

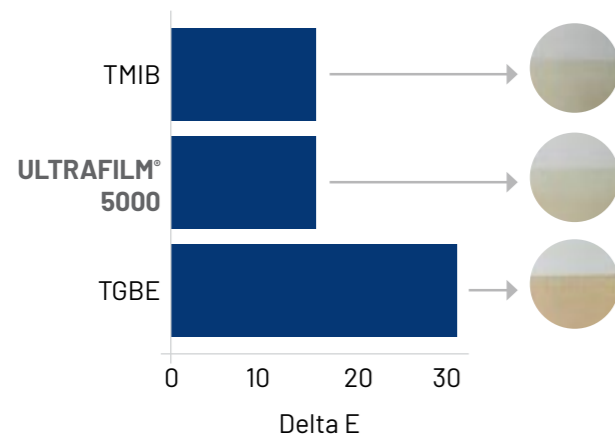


Dirt Pick-Up Resistance



Assesses how easily dirt adheres to the paint surface. Improved resistance helps maintain a clean look and reduces maintenance for exterior applications.

PAINTS DRIED FOR 40 DAYS, 25 °C, 60% RH

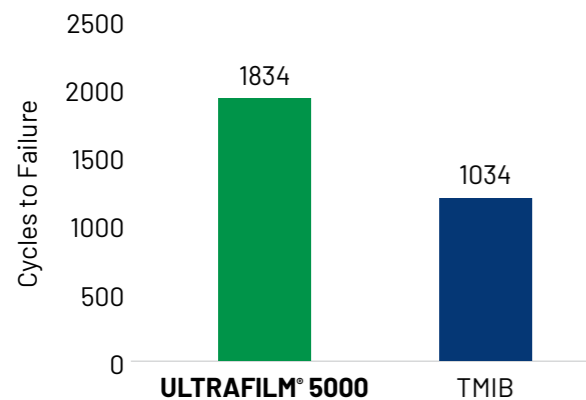


Instrumental test: Indorama Ventures' Internal Method for Dirt Pick-up.
Tested latex: Styrene-Acrylic (MFFT ~ 21 °C | Tg ~ 28 °C).
Test condition: 30% PVC paint cast on Leneta chart and dried @ 25 ± 5 °C, 60% R.H. Dirty was applied on the 40th day of drying.

Wet Scrub Resistance



Demonstrates the coating's ability to withstand repeated cleaning without degrading. Essential for maintaining durability and appearance in high-traffic interior areas.



Tested latex: Styrene-Acrylic (MFFT ~ 21 °C | Tg ~ 28 °C).
Test condition: 38% PVC paint tested according to ASTM D2486, method A.

Increased wet scrub resistance

Performance Tests

Accelerated Weathering Resistance - QUV Test



Simulates long-term exposure to sunlight, moisture, and temperature changes. Ensures that exterior coatings maintain their performance and appearance over time.

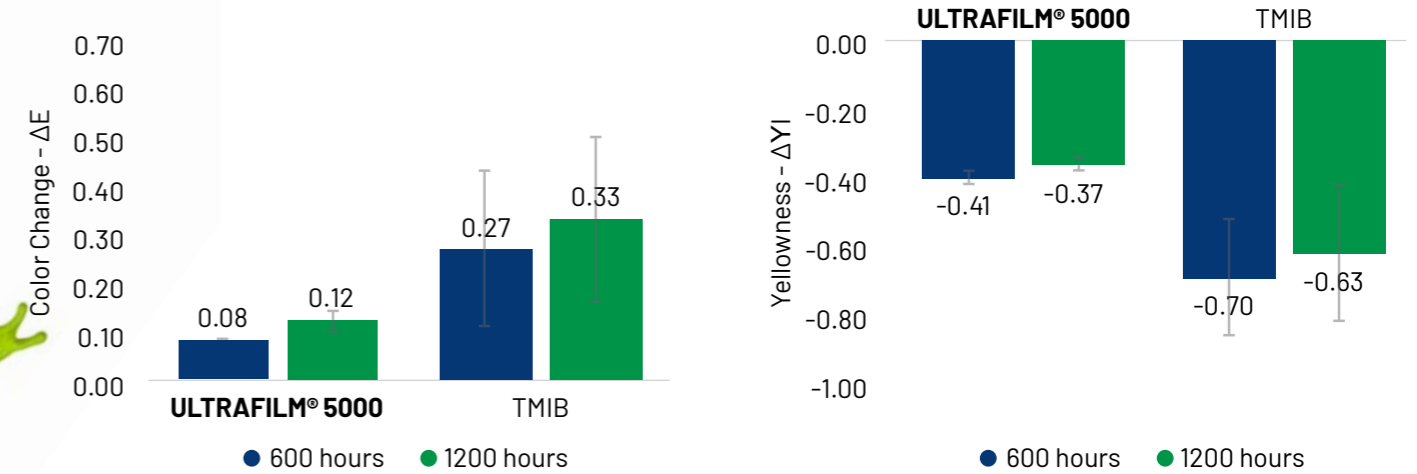
Formulation: 05LBR - Acrylic Semi-gloss

PVC	~ 32.0%
Latex Content	~ 35.0 wt%
Latex	Pure Acrylic
Coalescent	~ 14.0% (8.0% php)
Finishing	Semi-Gloss

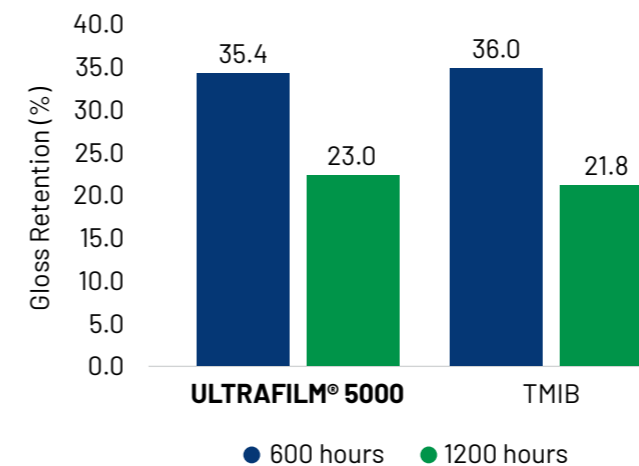
Test Conditions

Substrate: Aluminum
Wet thickness: 150 µm
Drying conditions: 25±2 °C and 60±5 % RH
Drying time: 7 days
Equipment: QUV-Spray
Lamp: UV-A, irradiance 0.77 W.m⁻².nm⁻¹
Cycle: 8h of UV Lamp at 60°C and 4h of condensation at 50°C
Exposure time: 1200h
Evaluated properties: gloss retention, color change, yellowness, cracking, calcination and blistering

Color Change



Gloss Retention



VISUAL ASPECT



TMIB

ULTRAFILM 5000



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