

ADVANCED RESISTANCE TO SALT SPRAY, UV RAYS, CHEMICALS & MORE

DuPont™ **Tedlar**® PVF Film *SUPERIOR, ADVANCED & PROVEN* 

Revolutionary Protection for Metal Panel Roofing and Wall Systems



TECHNOLOGY





## DuPont™ Tedlaſ® PVF Film

### **Superior Protection for Metal Roofing and Wall Panels**

With its unique mixture of strength, chemical inertness and weatherability, Tedlar<sup>®</sup> PVF film has provided long-lasting protection to important surfaces around the world since 1961. Trusted for its performance in extreme environments, Tedlar brings time-tested durability and beauty to architectural metal building products.

- ✔ Finishes that Maintain Their Appearance for Decades
  - ✔ Lot-to-Lot Color Consistency
- Surfaces Impervious to Harsh Chemicals, Solvents and Pollution
  - ✔ Does Not Support Mold, Mildew or Bacteria Growth
  - Unmatched Processability for Design Flexibility
  - ✓ Easy to Clean and Maintain & Stain Resistant
  - ✔ Available Exclusively Through Metal Alliance!

### All Backed by a Superior Performance Guarantee

Unlike other finish warranties that require a minimum 1500 ft. setback, metal roofing and wall panels finished with Tedlar<sup>®</sup> PVF Film are covered even for projects located directly on the shorefront for up to 50 years† against:

- ✓ Color change  $\Delta$ E94 ≥ 5 ✓ Chalk rating ≤ 6
- ✔ Visible checking, cracking or blistering

### Fresh Water Rinse Not Required

No Coastal Restrictions on Aluminum!



Weathertight Warranties Also Available

+Coastal eligibility on aluminum. Term dependent on vertical or non-vertical installation and color selected. Talk with a Metal Alliance representative for full warranty details and exclusions.

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Discover why Tedlar PVF film is far superior to any other types of metal panel coatings out there.

Learn how Tedlar has improved the way the world lives, travels and communicates for 60+ years.

Explore how the innovative science behind Tedlar makes it ideal for metal roofing & wall panels.

2 Compare how Tedlar PVF film performs against ASTM standards and other protective coatings.

View decades

View decades of real-world performance data for Tedlar PVF film on architectural applications.



From installation to service, get answers to the most common questions about Tedlar PVF film.

### DuPont™ Tedlar<sup>®</sup> PVF Film

### **ADVANTAGES**

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# ADVANTAGES OF TEDLAR®

**SUPERIOR METAL PANEL PROTECTION** Tedlar<sup>®</sup> PVF film outperfoms other protective coatings, including paint. Its unique molecular structure allows it to retain its advanced physical, chemical and mechanical properties even in the harshest conditions.



Offered on all standard grades of aluminum, metal panel roofing and wall systems finished with Tedlar PVF film deliver long-lasting beauty and performance. *Custom grades and steel available for specialty applications.* 



# **THE HISTORY OF TEDLAR**<sup>®</sup>

**DUPONT™'s SERENDIPITOUS DISCOVERY** and development of the world's first fluoropolymer in 1938 forever changed the plastics industry resulting in countless products with familiar names like Teflon®, Tyvek®, Corian® and more.

Since 1961 Tedlar has delivered superior protection to the world's most important surfaces. From buildings and transportation to aerospace and graphics, this revolutionary coating continues to lead the way in long-lasting performance.

Their leadership in harnessing the unique properties of fluoropolymers eventually led to the formulation of Tedlar, a PVF film that has continued to offer superior surface protection to new and ever-changing applications for over 60 years.



### THE HISTORY OF Tedlar® PVF Film



1990 **Tedlar introduced** as primer surface for automotive components



TODAY DuPont<sup>™</sup> Tediar<sup>®</sup> PVF film is trusted around the globe as the highperformance surface protection standard

2007 **NASA's Phoenix Mars** Lander uses Tedlar PVF film as part of its biobarrier

### THE HISTORY OF Tedlar® PVF Film



### **A SERENDIPITOUS ACCIDENT**

In 1938 while testing the chemical reactions of a refrigerant gas (TFE), DuPont researcher Roy Plunkett and a team of researchers discovered that one of the pressurized cylinders they were working with had failed to discharge. Setting it aside they noticed it was too heavy to be empty and proceeded to open it finding that the gas had inexplicably solidified into a white powder. Intrigued, Plunkett began testing the properties of the new substance. It was unaffected by known solvents, acids or bases, had an extremely high melting point and low surface friction. Over time the team found that the material's molecules had bonded, or become polymerized thanks to an impenetrable shield of fluorine atoms which locked onto and protected the compound's essential string of carbon atoms.

### **THE FIRST FLUOROPOLYMER - A REVOLUTIONARY INVENTION**

Plunkett soon invented a way to reproduce the polymerization in the lab, creating the world's first fluorinated polymer, or fluoropolymer. The breakthrough would revolutionize the plastics industry leading to countless products and applications that would have otherwise not been possible. DuPont went on to refine the polymerization process and in 1941 gave its new product a trade name: Teflon® for which it was awarded a patent. First used on machine parts for military and industrial applications, Teflon® found its most famous use as a seemingly miraculous nonstick surface for cookware in the early 1960s. Today, Teflon® has expanded into a whole family of polymers, found in industries as varied as aerospace and pharmaceuticals, and is sold worldwide.

### **DEVELOPMENT OF POLYVINYL FLUORIDE**

Building on their discovery, Dupont went on to successfully polymerize vinyl fluoride (VF) in 1942. An organic compound of carbon, fluorine, and hydrogen, VF shares an important characteristic with its polymerized predecessor, the carbon/fluorine (C-F) bond, often called the strongest bond in organic chemistry. Owing much of its durability to the unusual strength of the C-F bond, Polyvinyl/Fluoride (PVF) also exhibited excellent chemical and thermal resistant properties but with enhanced mechanical strength that made it extremely resistant to water and sunlight.

### **The Power of Repeated Attraction**

During polymerization, vinyl fluoride molecules combine to produce the polyvinyl fluoride polymer, a chainlike network of repeated VF monomers. Significantly, VF's single fluorine, the most electronegative of all elements, draws electron density away from the linear carbon backbone, effectively creating even stronger bonds when repeated throughout the PVF polymer chain. The resulting combination of unusual strength, chemical inertness and low permeability to air and water contributes to the superior performance of Tedlar against UV light, salt spray, pollution and harsh chemicals.

### THE HISTORY OF Tedlar® PVF Film



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# TECHNOLOGY **OF TEDLAR**<sup>®</sup>

SUPERIOR PROTECTION AS A FILM By the 1950s, DuPont was developing innovative applications for PVF, eventually recognizing its unique potential as a protective film. Demonstrating steady chemical, physical and thermal properties, PVF film could withstand harsh and corrosive environments, resist UV light and repel water. DuPont went on to receive the original registered trademark for its Tedlar<sup>®</sup> PVF Film in 1961 and officially introduced it for commercial use. For the next 60 years, Tedlar® PVF film's unique balance of strength, formability and resistance to some of the world's harshest conditions would find uses in countless industries from aerospace and transportation to healthcare and construction. Using these same intrinsic properties, Tedlar for architectural metal products is specially formulated to outperform all other types of protective metal coatings.

### **TEDLAR PVF FILM: A TECHNOLOGICAL BALANCE**

The innovative technology behind Tedlar is thanks to the film's unique formula and application process. The result is a formidable balance of durability and flexibility that is superior to other protective metal coatings including paint.

### **FILM COMPOSITION**

Tedlar PVF film is made from just two primary ingredients: a polyvinyl fluoride (PVF) polymer and pigments. PVF is the sole binder that creates the film and the central factor in its durability. Pigments provide color and set the gloss level, both of which dictate Tedlar's ability to reflect instead of absorb solar energy and provide greater durability.

### **100% PVF**

The transparent and flexible polyvinyl fluoride film requires no additives to aid in processing, using only the highly stable polyvinyl fluoride matrix. The film can be surface treated to accept a range of adhesives; unlike paint, the film does not require any additives to ensure adhesion to the metal. This keeps the exterior surface pure and maximizes performance outdoors.

### **COLOR & GLOSS**

Inorganic pigments with the highest level of inertness and durability provide color with the extra benefit of absorbing UV light and dissipating solar energy as heat. Gloss level is achieved using ceramic particles which roughen the surface for a smooth and matte finish that endures for many years.

### **STRETCHING & FINISHING**

A biaxial stretching and drying process creates a dense molecular grid for additional mechanical strength, abrasion resistance and a smooth surface free of pinholes and other uneven formations. Extruded under DuPont's strict quality standards, each batch of Tedlar PVF film is then certified to ensure that it meets the technical specs for metal substrate protection and batch-to-batch color uniformity.

during temperature fluctuations and fabrication.





### **OVER 60 YEARS OF PROVEN PROTECTION**

Time-tested for unmatched weather resistance and durability, Dupont<sup>™</sup> Tedlar<sup>®</sup> PVF film offers your metal building projects the superior surface protection they deserve - all backed by rigorous ASTM testing standards.

ASTM Testing Standards		Dove Gray	Mist Gray	Regal White	Verdant Green	River Blue	Dark Bronze	Charcoal Gray	Matte Black
COLOR & Reflectance Testing	Color: Lightness / Red-Green / Blue-Yellow	67.7 / -1.8 / 0.7	80.3 / -1.2 / 1.9	85.8 / -0.8 / 1.7	68.1 / -13.9 / 8.4	51.4 / -5.0 / -7.1	27.5/ 1.4 /0.3	33.9/0.1 /-1.2	33.9 / -0.2 /-1.3
	Specular Gloss 85°	13	9.4	10.6	14.7	11.6	14.5	14.5	13.3
	Initial Solar Reflectance	.31	.50	.61	.34	.41	.06	.09	.07
	Emissivity	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
	Solar Reflectance Index	32.9	57.9	72.6	36.6	45.6	1.2	5.1	3.1
PERFORMANCE TESTING	Chemical Resistance ASTM D1308	No blisters or visible changes							
	Falling Sand Abrasion ASTM D968	65±5 L/mil							
	Film Adhesion ASTM D3359	No removal of film under tape in the cross-hatched area (Dry, wet, boiling water)							
	Surface Burning ASTM E84	Meets and exceeds							
	Graffiti Resistance ASTM D6578/D6578M	Meets and exceeds							
	Humidity Resistance ASTM D2247	1000 hours: Aluminum - no field blisters							
	Impact Resistance ASTM D2794	Aluminum: 5 x metal thickness inch-pounds, no loss of adhesion							
	Pencil Hardness ASTM D3363	HB-F							
	Salt Spray ASTM B117	4000 hours: Aluminum no creep from scribe, no field blisters							
	T-Bends ASTM D4145	Less than 1T-no film breakage or loss of adhesion							
SOUTH FLORIDA Exposure Testing	Chalk Resistance ASTM D4214	No less than 6 after 25 years							
	Color Change ASTM D2244	No more than 4.5ΔE Hunter units at 25 years							
	Film Integrity ASTM G7	Up to 50 years							
	Erosion Resistance ASTM D662	0.025 mils at 10 years							
SUSTAINABILITY	Solar Reflectivity ASTM E1980-11	Up to 2 LEED credits based on SRI value of color selected							



**PROVEN PROTECTION AGAINST COLOR FADE AND CHALKING** Your projects are subjected to punishing UV rays, high heat, humidity, and many other extreme conditions. Metal roofing panels finished with Tedlar will experience virtually no color fade or chalking, allowing them to maintain their original appearance for decades.

### S. FLORIDA EXPOSURE RESISTANCE

Florida's outdoor exposure field is recognized in the industry as a standard test site for assessing the weatherability of coatings. Film samples are securely mounted with a southern-facing exposure at a 45-degree angle to measure color fade and chalking.

**15 YEAR** 14 COLOR CHANGE:  $\Delta E$  94 10

**RESULT: After 15 years, Tedlar® PVF film** significantly outperforms polyester and PVDF coatings.

### S. FLORIDA EXPOSURE RESISTANCE 20 YEAR

Another outdoor exposure test at the South Florida facility to measure color changes over 20 years for three different film samples. After 20 years of southern-facing exposure at 45 degrees, the samples were removed and compared in bright daylight to brand new films of the same colors.

**RESULT:** There is no perceptible color difference between the new films and old films, even after 20 years of daily exposure to harsh Florida conditions.



† Color change performance for Matte Black; 15-year performance ΔE < 4.5 based on color selected.



### PERFORMANCE OF Tedlar<sup>®</sup> PVF Film

### **PROVEN PROTECTION AGAINST CORROSIVE AGENTS**

Metal panels finished with Tedlar are impervious to harsh chemicals and cleaning agents and are highly resistant to corrosive environmental conditions like salt spray, acid rain and other pollutants.



vs. visible damage to PVDF.

### SALT SPRAY

Resistance to corrosion from sea water and salt spray is tested by exposing an atomized saltwater solution inside an enclosed chamber at very high temp and humidity conditions, creating a highly corrosive environment.

**RESULT:** After 2000 hours of exposure Tedlar<sup>®</sup> PVF Film has far superior resistance compared with PVDF. Tedlar® PVF Film is unchanged vs. visible corrosion to PVDF.

### After 2000 Hours



**PVDF COATED** 



After 2000 Hours

**TEDLAR® PVF FILM** 

### PROVEN PROTECTION AGAINST CRACKS AND ABRASIONS

Tedlar PVF film can be stretched in any direction to more than twice its original length without cracks, loss of adhesion or color change. The dense molecular grid is also highly resistant to scratches and abrasions.

### T-BEND

To demonstrate processability, a 180degree 0T bending test (seen here at 40x magnification) was conducted to compare the performance of Tedlar<sup>®</sup> film laminated steel vs. a PVDF paint-coated steel sheet.



**RESULT: Tedlar® PVF Film exhibits no crack**ing even at 180-degree bending, while the PVDF coated steel sheet shows obvious cracking.

### ABRASION RESISTANCE

Falling sand abrasion tests were conducted for PVDF coating and Tedlar<sup>®</sup> PVDF film each at a 45-degree angle for signs of scratching and coating penetration.

**RESULT:** The PVDF coating shows faster signs of wear at 80 L while Tedlar<sup>®</sup> PVF film is able to resist significantly more abrasion to volume of 240 L.

### S. FLORIDA EXPOSURE RESISTANCE 20 VEAR

After 20 years of southern-facing exposure at 45 degrees, samples were viewed under a microscope and magnified five times to evaluate for cracks and abrasions.

**RESULT:** At 5 times magnification, Tedlar PVF film shows no signs of cracking, blistering or checking even after 20 years.

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# **CASE STUDIES OF TEDLAR**<sup>®</sup>



### **CHALKING & CORROSION**

- ✓ Luxury hotel built in 1974 using metal cladding coated with Tedlar® PVF film
- ✓ Pictured at right in 2011 the original Tedlar PVF film is in pristine condition no yellowing, chalking or corrosion
- Appearance of facade is virtually the same after 45 years



1974

2011

### **COLOR FADE, LOT-TO-LOT & COASTAL EXPOSURE**

- ✔ Coastal industrial plant finished with Tedlar PVF film panels in 1984
- ✓ Plant expanded using same color Tedlar PVF film on addition in 2010
- ✓ After 26 years, no visible color change in originally installed panels, no difference in lot-to-lot colors, and no rusted edges



### COLOR FADE

- ✔ Office building finished with Tedlar PVF film metal cladding in 1983
- ✓ More than 3 decades later. the original matte, smooth exterior is nearly indistinguishable from Tedlar<sup>®</sup> standard color chart



1983

2020

### CHEMICAL RESISTANCE

- ✓ Steel roof panels regularly exposed in chemical plant were being replaced every 2 years due to corrosion
- ✓ Beginning in 2016, metal panels finished with Tedlar PVF film were installed as replacements
- ✓ After 2 years a side-by-side comparison shows Tedlar PVF film panels had no corrosion compared to corroded panels with other coating

### COASTAL EXPOSURE

- ✔ Panels finished with Tedlar PVF film in 1986
- ✓ Daily exposure to high salt spray environment along the coast
- No rust, even at edges and almost no color change after 27 years

### **RUST RESISTANCE**

- ✓ Tedlar PVF coated roof panels installed in 1983 at industrial plant
- ✓ PVC-coated panels on same substrate and same profile installed 16 years later in 1999
- ✓ By 2013 the PVC-coated panels are severely rusted after only 14 years while Tedlar finished panels installed 30 years prior show no rust or visible change





**Other Coating AFTER 2 YEARS** 



Tedlar **AFTER 2 YEARS** 



1986 **TEDLAR INSTALLATION** 



2013 **NO COLOR CHANGE OR RUST** 



2013: Tedlar Looks the Same after 30 Years



2013: Other Coating w/ Severe Rust after 14 Years

# FAQS ABOUT TEDLAR®



Tedlar® PVF film is superior to other protective metal coatings including paint thanks to the film's structure and highly stable 100% PVF polymer. Tedlar can be treated with a range of adhesives directly to the metal coil when processing without the need for additives which can cause early degradation. The film's inert chemical properties make it impervious to harsh chemicals and corrosive agents like salt spray. In fact aluminum applications, including those directly on the ocean, come with a warranty against color fade and corrosion for up to 50 years<sup>+</sup> - no annual freshwater rinse required.

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I HAVE A PROJECT THAT REQUIRES A COLOR NOT SHOWN ON THE CHART. HOW CAN I GET TEDLAR? Stock colors are always the best choice for timely project completion; on larger projects we can evaluate additional color availability to meet your needs.

CAN I ORDER TEDLAR FINISHED METAL TO MATCH A TEDLAR PROJECT I DID YEARS AGO? Yes! Due to the color uniformity of Tedlar film from lot-to-lot and the resistance to fading once installed, replacement panels or new panels for an addition can be ordered in the same color as the original order.

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### HOW DOES TEDLAR PVF FILM PROTECT METAL ROOFING AND WALL PANELS?

Metal panels finished with Tedlar are proven in real-world exterior applications to deliver advanced protection from harsh UV rays, pollutants and even salt water. Inert and non-reactive, it also offers unmatched resistance to harsh chemicals and cleaning agents and doesn't support mold or mildew growth.

### IS TEDLAR TESTED FOR PANEL PERFORMANCE IN HURRICANE ZONES?

Yes, metal roofing and wall panels made with Tedlar PVF film are UL listed, Florida Product Approved and approved for use in High Velocity Hurricane Zones (HVHZ), including Miami-Dade County.

### HOW RELIABLE IS THE COMPANY BEHIND TEDLAR?

Developed by DuPont<sup>™</sup> in 1961, Tedlar<sup>®</sup> PVF film has over a 60-year history of protecting important surfaces all over the globe. DuPont, founded in the U.S. in 1802, remains one of the world's premier manufacturers of products that have transformed everyday living, including those with familiar names like Kevlar®, Tyvek®, Corian® and many more.

Metal Alliance is your architectural metals supply authority. Get the quick answers you need to frequently asked questions about Tedlar PVF film here.

### **DOES TEDLAR PVF FILM COST MORE THAN PAINT COATINGS?**

Tedlar is a premium product priced comparably to many paint-based coatings. At Metal Alliance we are committed to offering the best metal products in the industry, at the best value. Depending on the supplier, investment in Tedlar protected metal coil and flats may be slightly higher.

### DO METAL ROOFING PANELS FINISHED WITH TEDLAR® REQUIRE ANY EXTRA MAINTENANCE **COMPARED WITH OTHER METAL ROOF COATINGS?**

No, Tedlar® PVF film's unique chemical inertness make it impermeable to grease, dirt and other pollutants as well as harsh chemicals and cleaning agents. In fact, the Tedlar material warranty does not require a twice annual fresh water rinse or maintenance documentation compelled by other coating warranties.

### IS TEDLAR PVF FILM ECO-FRIENDLY?

Yes, Tedlar PVF film's dense surface is non-reactive and inert. It is non-flammable and has low smoke toxicity. It does not support mold, mildew or bacteria growth and produces very low VOC emissions. Projects that specify Tedlar PVF film may also qualify for LEED credits based on SRI of color selected.



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### DO TEDLAR® FINISHED PANELS REQUIRE ADDITIONAL STEPS FOR ROOF OR WALL INSTALLATIONS?

No, metal panels finished with Tedlar® PVF film are installed using the same installation guidelines, regulations, building codes and industry practices used for other types of coated metal panels.

### CAN TEDLAR® PANELS BE FABRICATED USING THE ROLLFORMING EQUIPMENT I'M ALREADY USING? Yes, Tedlar® PVF film panels can be formed into the same profiles using the same equipment as any other types of metal panels.

DO PANELS FINISHED WITH TEDLAR<sup>®</sup> REQUIRE ANY SPECIAL HANDLING DURING INSTALLATION? No, Tedlar metal panels are easy to install and hardier during installation than panels finished with other coatings.

\*Coastal eligibility on aluminum. Term dependent on vertical or non-vertical installation and color selected. Talk with a Metal Alliance representative for full warranty details and exclusions.

### FAQS ABOUT Tedlar® PVF Film

# UNMATCHED PROTECTION FOR METAL ROOFING AND WALL PANELS

Tedlar<sup>®</sup> PVF Film

Available Exclusively Through

# **METALALLIANCE** A Value Added Supplier of Metals

### A Value Added Supplier of Metals

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