

DUPONT™

Tedlar® films

Innovative Solutions for Transportation Surfaces

November 2020



What is Tedlar®?

Tedlar® is a DuPont registered trademark for a **highly versatile polyvinyl fluoride (PVF) film** that provides a long-lasting finish to a wide variety of surfaces exposed to harsh environments; while its inert, non-stick properties make it an excellent release film.



Why Tedlar®?

Interiors

- ✓ Cleanability
- ✓ Chemical/solvent resistant
- ✓ Stain/graffiti resistant
- ✓ Excellent flame & smoke rating
- ✓ Long term protection
- ✓ Endurable style
- ✓ Excellent formability
- ✓ Does not support the growth of Mold and Mildew
- ✓ Heat sealable
- ✓ Ink & print receptive

Exteriors

- ✓ UV & weather stability
- ✓ Chemical resistance
- ✓ Stain/dirt resistant
- ✓ Temperature stability
- ✓ Colour stability
- ✓ Range of surface gloss
- ✓ Low toxicity & volatiles
- ✓ Bendability
- ✓ Low gas/ vapor permeability
- ✓ Sound transmitting

Tedlar® PVF Applications

Proven applications, globally, for over 50 years



Aerospace & Transportation



Building & Construction



Signage



Healthcare



Industrial



Composite Release



Photovoltaics



Tedlar® Product Offerings

Protective & Decorative films

- Provides a durable, reliable finish that can protect surfaces exposed to harsh weather, UV rays, chemicals, solvents and staining agents. Resistant to the growth of mold, mildew and bacteria.



High-Performance Release films

- As an inert, non-stick film, Tedlar® high-performance release films provide an excellent quick release from epoxy, phenolics, polyesters and rubber compounds; provides a consistent surface finish quality that may reduce or eliminate the need for additional processing or finishing steps.



- **Also: Polymers, PVF Dispersions, and Adhesives**



Tedlar® PVF films, Dispersions & Polymers: Demonstrated Substrates & Commercial Applications

Tedlar® Products, Application Process	Substrates that Tedlar® is Applied to...	Applications / Uses
Tedlar® PVF films & Adhesives, via Lamination	PET	Solar panel backsheets, automotive brightwork
	Steel	Building roofing, siding, etc.
	Aluminum	Building Siding
	Poly (vinyl chloride) a.k.a. “Vinyl “	Sports domes, tents, wallpaper, signage & graphics, awnings, automotive trims, passenger rails
	Engineering thermoplastics (ABS, polycarbonate)	Hard signs, touch membranes, thermoformed parts, aerospace, skylights
	Aramid (Nomex®, Epoxy and phenolic)	Aerospace panels
	Fiberglass reinforced plywood panels (FRP)	Truck bodies
	Glass reinforced plastic panels (GRP)	Greenhouses, skylights, building panels, electric utility boxes, radome panels
	Scrims	Reinforcement for insulation liners in aerospace
	Foil	PV, pipe jacketing
	Urethane & Vinyl	Roofing, aerostats/blimps
	Dacron™ & Mylar® PET	Sailcloth protection (marine)
	Bitumen	Low angle roofing
	Tedlar® PVF film	Heat seal to create envelopes for gas sampling, acoustical wraps, insulation bags, (Bridge) cable wraps
Tedlar® PVF Dispersions or Polymers, via Coating	PET	Solar panel backsheets, release films, etc.
	PVDF	Chrome-look surfaces (automobiles, rail, appliances)
	Steel	Brake fluid tubing, architectural panels
	Fabrics	Architectural fabrics (tents, domes, etc.)

Current Use Case: Tedlar® in Commercial Passenger Aircraft

Tedlar® has protected the interiors of aircraft since 1964 and continues to be the industry-recognized standard today.

Tedlar® was chosen in commercial aircraft due to its high standard of non-flammability. It is certified by FAA and EASA with excellent fire resistance.

Tedlar® continues to be used because of its durability. The interior of aircraft see thousands of customers over years and are able to stay looking clean year in year out.



Interiors

- Sidewalls
- Stow bins
- Window shades
- Ceiling panels
- Partitions
- Monuments
- Galleys
- Lavatories
- Closets

Secondary Structures

- Landing Gear Bay
- Insulation Blankets
- Cargo Protection
- Labeling
- Composite Release
- Composite Protection



Passenger Rail Applications

Similar to Aircraft, passenger rail seems similar traffic flow of customers through the doors daily.

The overall durability, stain resistance, and cleanability make Tedlar® ideal for many different areas inside and outside a rail car.

Tedlar® has great thermoformability making it ideal for manufacturing interior sidewalls.

Potential Application Areas:

- Sidewalls
- Doors
- Ceiling panels
- Partitions
- Graphics and Signage
- Interior insultation
- Seats casing and backsides
- Galleys
- Lavatories
- Closets
- HVAC

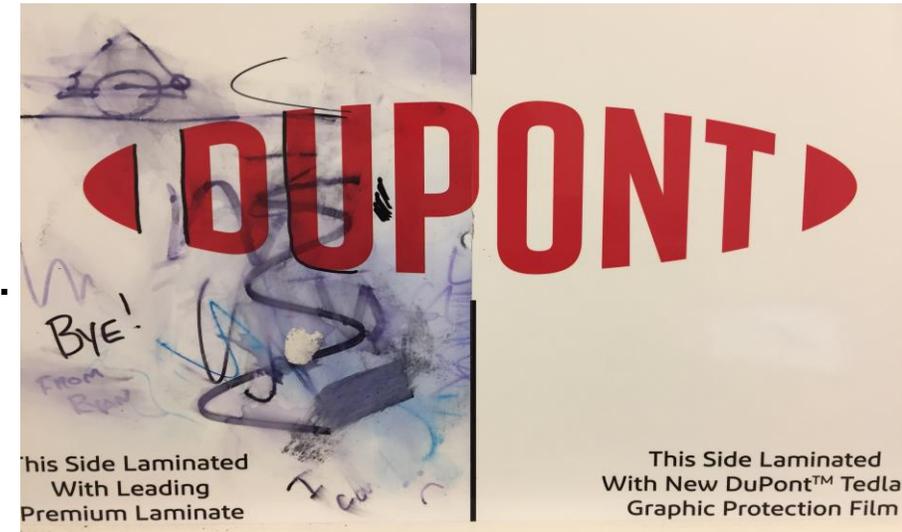


Unique Values for Rail

- ✓ **Long-term Protection**
 - Provide a protective barrier against most staining agents and cleaning solvents, including: bleach, alcohols, ketones (acetone, MEK) and even strong acids and alkalis.
- ✓ **Flame resistance**
 - Non-flammable and low smoke toxicity
 - Used in aircrafts; Exceed the ASTM E84 Class A rating.
- ✓ **Mold and Bacteria resistance**
 - Tedlar® is naturally flexible and does not need processing aids or additives (plasticizers) that provide nutrients for mold or bacteria growth.
 - Tedlar® surface has been tested and certified using ASTM G21, JIS Z 2801, and ISO 846:2019(E). Results indicate that the films do not contain nutritive components for the bacteria or fungi tested to grow.
- ✓ **Easy Cleaning**
 - Stain resistant to various species in healthcare environment, easy to clean completely after 24h dwell time
- ✓ **Indoor Air Quality**
 - Maybe be able to receive UL Greenguard GOLD for Low VOC and Mold Resistant. Tedlar currently have certificates for Wallcoverings.
- ✓ **UV Light Resistant**
 - ✓ PVF does not absorb UV radiation and maintains low color change when exposed to UVA, UVB, or UVC light for sterilization.
- ✓ **Versatile Design and Enduring style**
 - PVF is naturally transparent with low color.
 - Color is stable during use in harsh environments.
 - Scrub resistant surfaces are ideal for high traffic areas

Cleanability of Tedlar® Film

- Cleaning the interiors is a balance:
 - Aggressive enough to remove a wide range of staining agents
 - Mild enough that it doesn't permanently damage the substrate being cleaned
- Surfaces coated with Tedlar® can make this selection easier.
 - Makes vehicles look cleaner longer
 - Can eliminate multiple cleaners and lower maintenance costs
 - Allow for use of wide range of “graffiti removers” without damaging surfaces



Cleaning and Stain Resistance

- All products were applied to Tedlar® PVF Film and allowed to set for 24 hours. Utilizing the following methods, all products were successfully removed from the Tedlar® PVF Film with no damage to the Tedlar® film.

Dry Cloth Cleaning	Wet Cloth Cleaning	Mild Detergent	Solvent
Baby Oil	Human Sweat	Oily Pen	Ball Point Pen
Acid Solutions*	Urine	Mercurochrome	Surgical Fine Tip Marker
Acetone	Stomach Acid	White Board Marker	Permanent Marker
Butanone	Skin Moisturizer	Lipstick	Spray Paint
Ethylalcohol	Sunscreen Lotion	Ketchup	
Glycol	Iodine	Shoe Polish	
Toluene	Coffee or Tea		
	Red Wine or Grape Juice		
	Black Crayon		
	Mustard		
	Brake Fluid		

*Acid solutions include: acetic acid, 10% nitric acid, 20% hydrochloric acid, and 30% sulfuric acid

Disinfectant Resistance

Tedlar® film is compatible with many acidic, basic, and solvent based substances that can be found in cleaning agents and disinfectants.

Surfaces protected with Tedlar® will not break down over time from continuous disinfecting.



Disinfectants	Result
Clorox™ Healthcare Bleach (10%)	☺
Oxivir TB: Hydrogen Peroxide (0.5%)	☺
Virex II 256: Quaternary	☺
Hand Sanitizer: Isopropanol (70%)	☺
Oxycide (Hydrogen Peroxide and Peroxyacetic Acid)	☺

- Test was completed depositing 2.5ml of solution each day for 5 days on surface then cleaned afterwards to check for damage

Chemical Resistance

Chemical resistance is the ability of the material to maintain its chemical and physical properties after being exposed to a chemical substance (e.g., acids, bases, solvents).

Depending on the surface material composition of furniture walls, flooring, or any surface of concern and interest, a change to the surface can occur almost instantaneously, permanently damaging the surface exposed if the surface is not adequately protected.

Tedlar® film has exceptional chemical resistance.

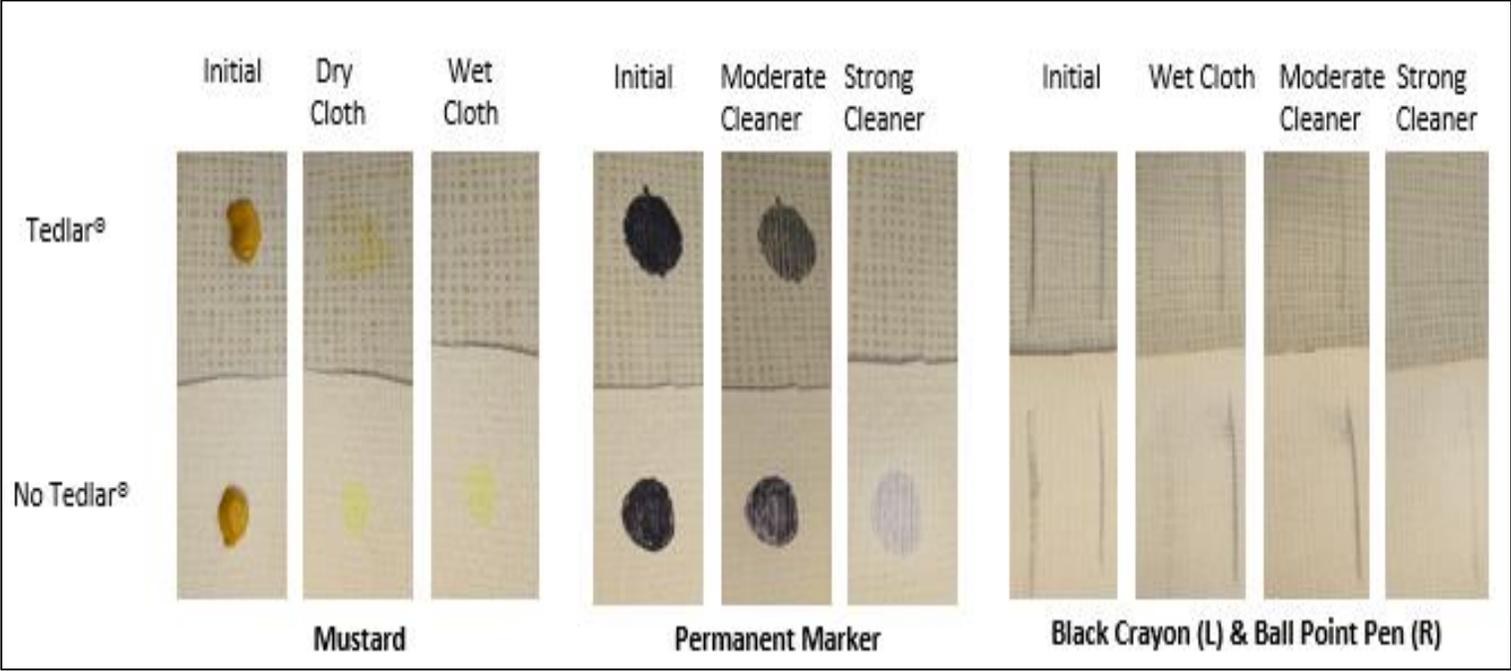
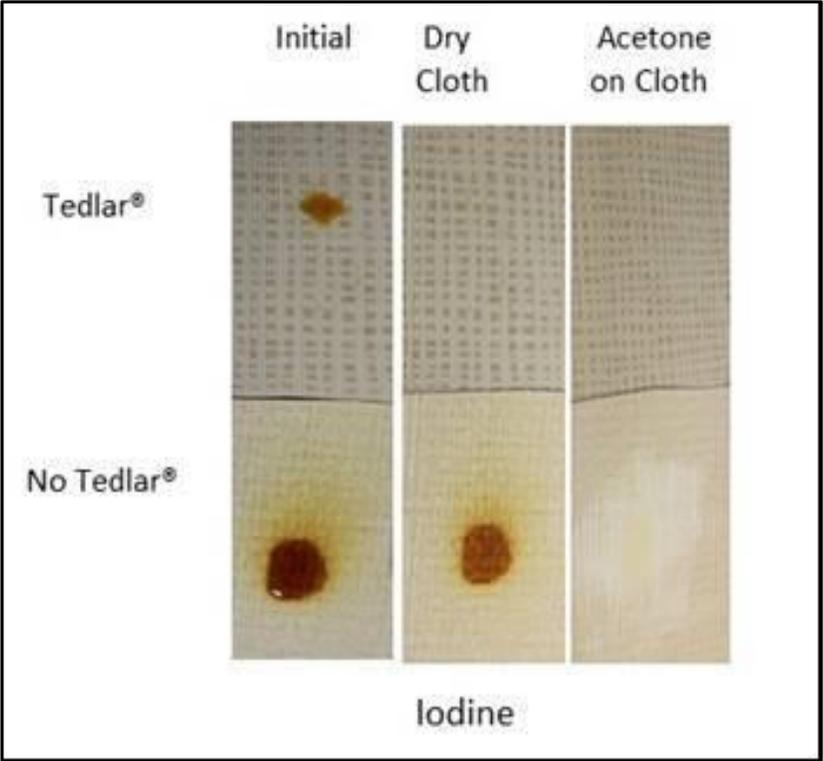
Cleaners and Solvents	Result
Glance: Non-ammoniated cleaner	☺
Stride Citrus Cleaner	☺
Ammonium Hydroxide (10%)	☺
Acetone	☺
Ethanol	☺
Isopropanol	☺
Methyl Ethyl Ketone	☺

- Testing was completed using acids, bases, solvents and miscellaneous chemicals after immersion for 1 year at 25 °C and for 2 hours at boiling conditions. All samples were given an 'E' that denotes that there was no perceptible change of either appearance or mechanical properties after the exposure.

Tedlar® Chemical Resistance and Cleanability

The following examples show how materials can be protected from stains and chemicals by applying Tedlar® protective film as the outer layer. Below Tedlar® was applied to PVC wallcovering then tested with various stains and cleaning methods.

The PVC wallcovering that is protected with Tedlar® looks brand new even after cleaning with acetone.



Flame and Smoke

- Tedlar® PVF film has long been recognized as a safe material for the interior of transportation vehicles due to its low flammability and smoke development.
- Components containing Tedlar® as a protective film have performed well against current industry test protocols.
- Certified by FAA and EASA with excellent fire resistance
- Class A Rating for Interiors: ASTM E84 Class A and NFPA 286

Tedlar® film is used extensively on cabin interior walls and ceilings of commercial aircraft.



Tedlar® is superior to paint in a variety of areas:

Quality

- Even thickness and no pinholes

Durability

- Higher resistance to abrasions, scuffs, chemicals, impact, and UV

Impact resistance

- Minimal cracking and chipping caused by luggage and other impact

Aesthetics after impact

- Chips and damage after impact are easy to see with paint

Repair after impact

- Superior color matching and blended repairs

Cleanability

- Higher stain resistance
- Oil from hand-oils are easier to clean off
- Ability to use more aggressive cleaners
- No discoloration or change in gloss after cleaning

Aftermarket costs

- Lower cost for MRO shops

No Holistic paint costs

- Tedlar® has lower cost associated with surface preparation, equipment and materials, quality control, waste management, laborer safety, fire safety, etc.



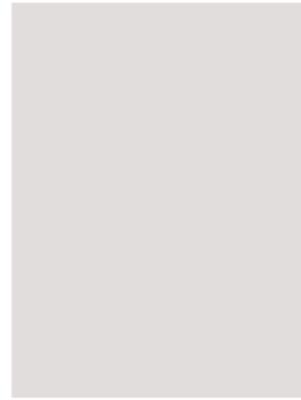
A photograph of a crowded subway car. In the foreground, two young women are smiling and looking towards the right. The woman on the left has her arm around the woman on the right. The woman on the right is holding onto a handrail. In the background, other passengers are visible, including a man wearing a face mask. The text 'Tedlar® Design Possibilities' is overlaid on the image.

Tedlar® Design Possibilities

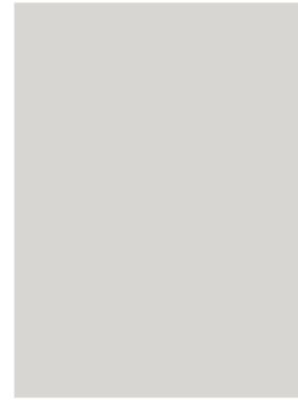
Colors

Tedlar® is available in a variety of standard colors including Clear UV Stable

Examples of colors (more are available on demand):



Shell white
TWH15BL3
Choice color



Birch white
TBW15BL3



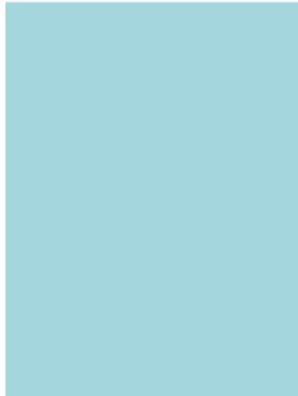
Dawn gray
TGH15BL3
Choice color



Misty gray
TMG15BL3
Choice color



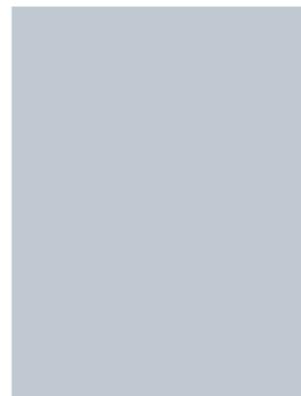
Light gray
TGL15BL3



Light blue
TNB15BL3



High sky
THS15BL3
Choice color



Tokyo day
TTD15BL3



Heron feather
THF15BL3



Salem blue
TSB15BL3
Choice color

Custom Colors and Pigmented Effects



(Color Flop)

Customized color matching is possible with Tedlar®

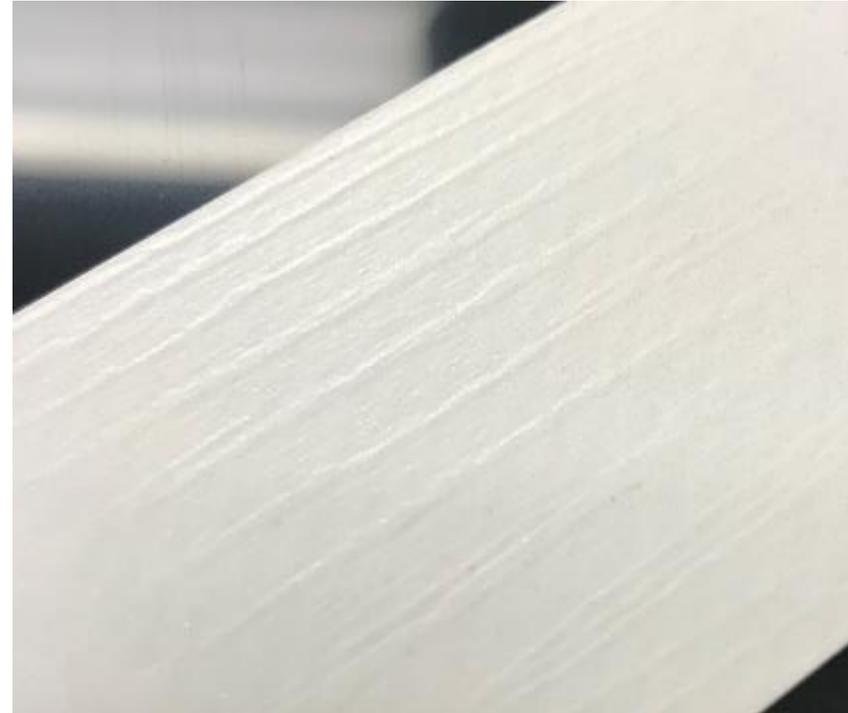


Pearlized Tedlar®



Pigments can be added directly to the Tedlar® dispersion prior to casting, creating a pearlized Tedlar® film.

Embossed Tedlar®



During the lamination process, transfer paper can be used to create a wide variety of textures, such as leather and wood grain effects.

Metallized Tedlar®



Tedlar® film can be metalized, creating stainless steel and chrome looks

High Resolution Sublimation Printed Tedlar®



Tedlar® clear film has the ability to diffuse high resolution dye sublimation inks into the film. The high resolution image is encapsulated and protected by the clear Tedlar® film.



Sublimation Printed Wood/Stone Tedlar®



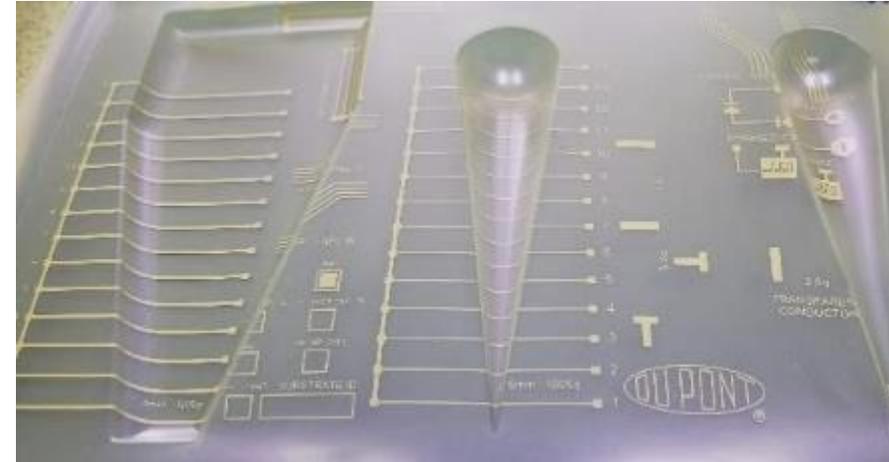
The dye sublimation process enables a wide variety of surface appearances using Tedlar® clear film. Combined with embossed textures, this technique creates a surface with a unique look and feel.

Thermoformability



Tedlar® film is thermoformable, expanding the use of the material beyond flat surfaces.

Conductive Ink/In-Mold Printed Tedlar®



Conductive inks can be printed directly on the back of Tedlar®. This film can then be laminated and thermoformed enabling lighting, temperature, and volume controls a touch away from the end user.





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