



Lubrizol

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LUBRIZOL
ENGINEERED
POLYMERS

**ADVANCING MATERIALS.
ELEVATING PERFORMANCE.**



ESTANE® TPU:
**High Performance Solutions for
Surface Protection**

UL Webinar

EVERYDAY SURFACES



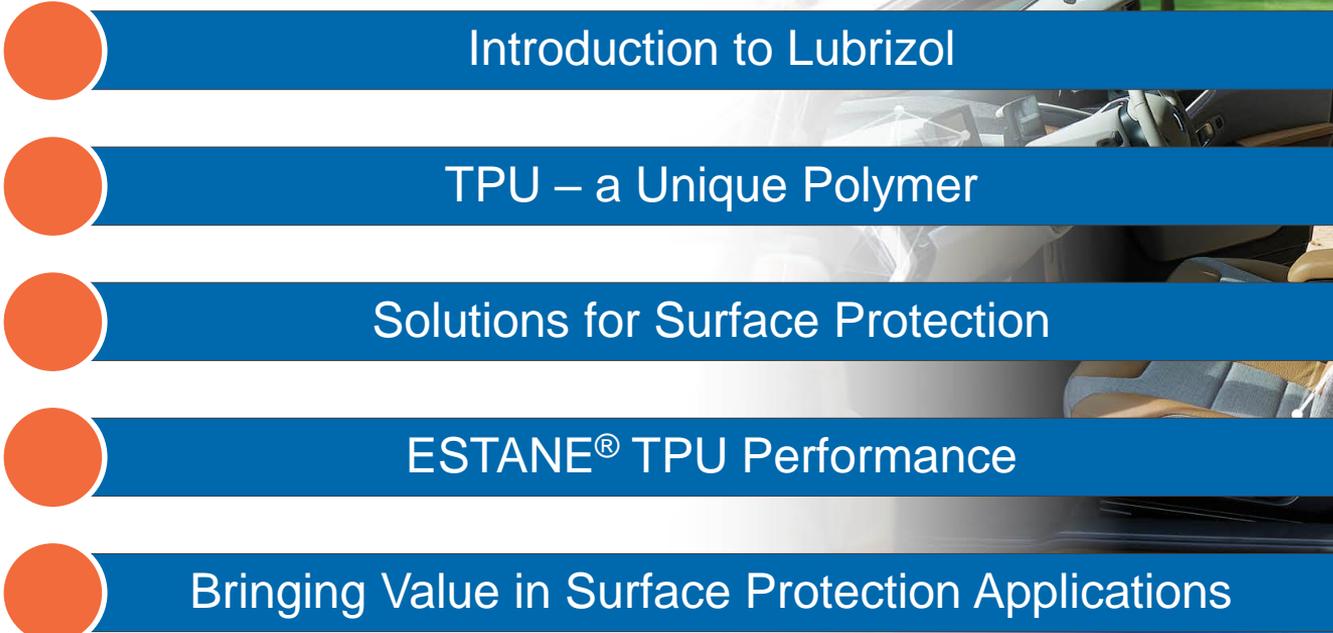
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SURFACES TO PROTECT



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PRESENTATION CONTENT



Introduction to Lubrizol

TPU – a Unique Polymer

Solutions for Surface Protection

ESTANE® TPU Performance

Bringing Value in Surface Protection Applications

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THE LUBRIZOL CORPORATION

A Berkshire Hathaway company

- Chairman & CEO Warren E. Buffett
- Portfolio of more than 60 businesses

The Lubrizol Corporation, established 1928

- A global specialty chemical company
- Headquartered in Cleveland, OH
- 2020: Over 8,800 employees
- Serves customers in over 100 countries from a well-networked global structure



Employees
Globally

8,800

Labs/Technical
Facilities

39

Manufacturing
Sites

58

Sales
Offices

48

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ABOUT LUBRIZOL

Our Mission

We leverage our unmatched science to unlock immense possibilities at the molecular level, driving sustainable and measurable results to help the world **move cleaner**, **create smarter** and **live better**

Move Cleaner

- Enable a >50% reduction in vehicle emissions by 2040

Create Smarter

- Improve the circularity of our products by 25% by 2028

Live Better

- Improve at least 2 billion lives through our solutions by 2028

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SUSTAINABILITY AT LUBRIZOL

Maximizing our positive impact on people and planet

Environmental

- » Energy, Emissions and Climate Change
- » Product Footprint and Lifecycle Thinking
- » Sustainable Sourcing
- » Waste and Recycling
- » Water Consumption and Safety
- » Air Quality



Social

- » Workplace Health, Safety and Security
- » Product Health and Safety
- » Community Involvement
- » Employee Attraction, Engagement and Retention
- » Diversity and Inclusion
- » Human Rights and Fair Labor Practices

Governance & Ethics

- » Corporate Governance
- » Ethics
- » Sustainable Growth
- » Innovation, Research and Development
- » Information Security

Lubrizol

LUBRIZOL ADDITIVES

Product Lines

- Driveline Additives
 - Engine Oil Additives
 - Fuel Additives
 - Industrial Lubricants
 - Viscosity Modifiers
- **Develop** products that play an essential part in the proven performance of the finished lubricant
 - **Extensively test** additives in the lab and in the field under real-world conditions
 - **Help customers differentiate** and succeed through trusted expertise, testing confidence, global supply and independent strength

Our products keep the world moving...



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LUBRIZOL ADVANCED MATERIALS

Global Business Units

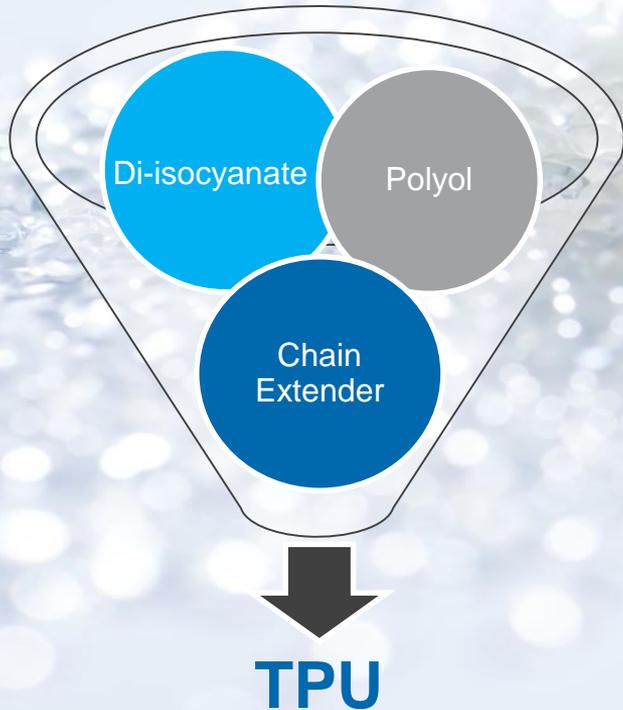
- Engineered Materials
 - **Engineered Polymers**
 - Performance Coatings
 - CPVC Piping Systems
 - Lubrizol Life Science
 - Beauty and Personal Care
 - Home Care
 - Life Sciences Health
- **Create** proprietary, high-performance materials for customers in a wide range of industries
 - **Apply** core polymer and surface active chemistries and formulations know-how
 - **Accelerate** development cycles and customer success through collaboration, strategic partnerships and a well-networked global team

At work... at home... Anywhere you are!



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WHAT IS TPU? (THERMOPLASTIC POLYURETHANE)



Properties optimized through ingredients:

Abrasion Resistance	Impact Resistance	Puncture Resistance	UV Resistance and/or Filtering
Chemical Resistance	Hydrolysis Resistance	Hardness (52A → 85D)	Thermal Extremes
Barrier Properties	Fungal Resistance	Optical Clarity	Polymer Compatibility
Static Dissipation	Antimicrobial	Flame Resistance	CoF

VALUED IN HIGH PERFORMANCE APPLICATIONS



Anti-Static Apparel



Athletic Footwear



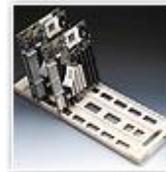
Clean Room



Disk Drives



Electronics



Electronics Processing



Electronics Trays



Food Conveying



Hose, Tube & Profile



Industrial Equipment



Material Handling



Outdoor Gear



Performance Apparel



Robotics



Recreation



Seals & Gaskets



Semi-Conductor



Specialty Fibers



Specialty Hose & PPE



Soft Touch Surfaces



Surface Protection Films



Tape & Reel



Winter Sports



Wire & Cable

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ESTANE® TPU FOR SURFACE PROTECTION

Diverse End Uses

- Paint Protection Film
- Graphics Wraps
- Signage & Durable Labels
- Decorative Films
- Protection of Susceptible Surfaces



Markets

- Architectural
- Consumer
- Electronics
- Flooring
- Outdoor Equipment
- Renewable Energy
- Transportation

ESTANE®
THERMOPLASTIC POLYURETHANES

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SPOTLIGHT: PAINT PROTECTION FILM (PPF)

ESTANE® TPU is the **most consistent, high-quality** surface protection solution enabling **efficient processing and performance**.

PPF Cross-section:



Features	Benefits
Clarity	“invisible” on surface
Impact Resistant	Protects surface from damage
Wettability	Compatible with adhesives, top coats
Self-healing	Maintains aesthetics
Weatherability	Resistance to UV and elements

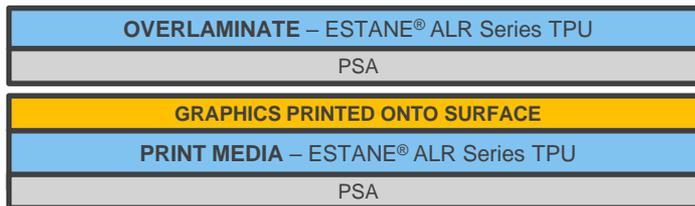


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SPOTLIGHT: AUTOMOTIVE GRAPHICS FILMS

ESTANE® TPU is a **non-vinyl, plasticizer free** surface protection and print media solution that provides **superior durability** and **ease of use** during installation and removal.

Graphics Wrap Cross-Section:



Features	Benefits
Durability	Protects the graphics from damage
Low Temp Flex	Wider range of installation conditions
Wettability	Compatible with adhesives, inks
Self-healing	Maintains aesthetics
Weatherability	Resistance to UV and elements



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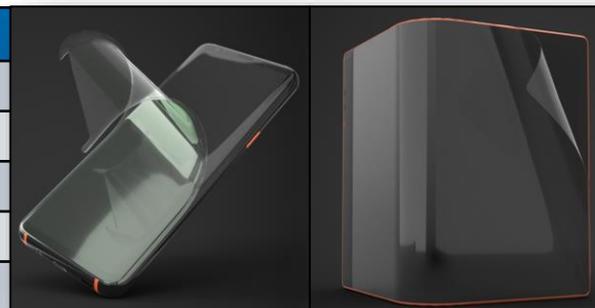
SPOTLIGHT: SCREEN PROTECTION FILM

ESTANE® TPU is an **ideal solution for screen protection** film to protect smartphones, smart watches and flexible displays from everyday life.

Screen Protection Cross-Section:



Features	Benefits
Flexibility	Protect rounded and curved edge screens
Clarity	Maintain visibility of the original display
Adhesion	Compatible with adhesives
Scratch/Stain	Exceptional resistance with coating layer
Sensitivity	Excellent fingerprint and touch sensitivity



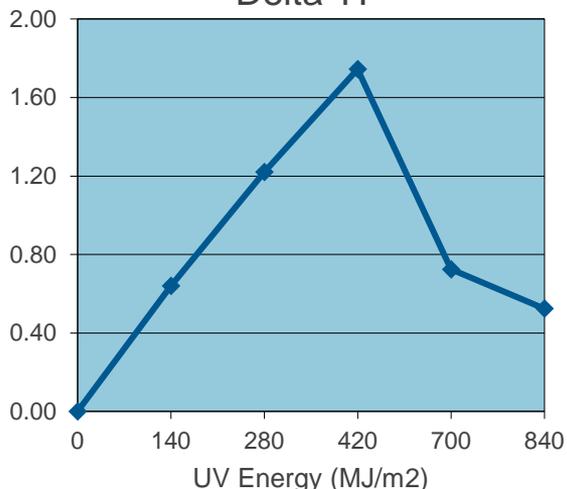
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WEATHERING – ESTANE® ALR SERIES TPU

Florida Equivalent Weathering, per ASTM G90 cycle 3

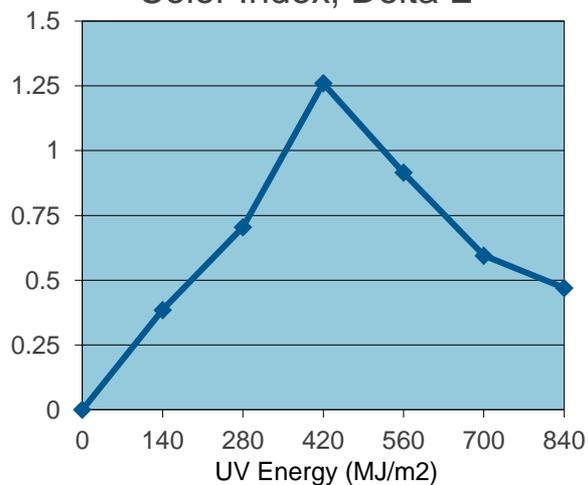
- 840 MJ/m² = 3 years equivalent Florida exposure

Delta YI*



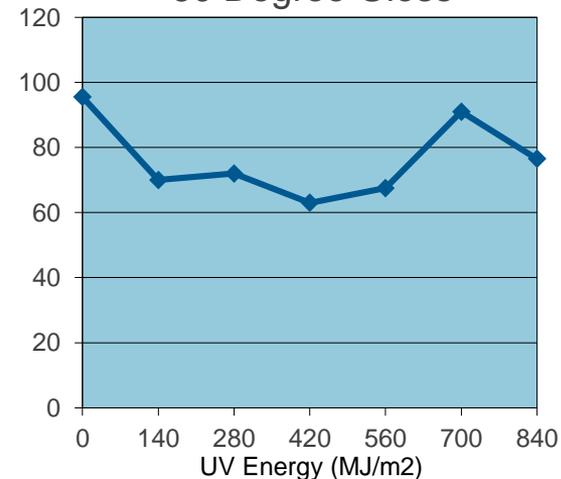
*Any change less than 8 is not visible

Color Index, Delta E*



*Change not visible below 1.7

60 Degree Gloss*



*BYK-Gardner Micro-TRI-Gloss gloss meter
(change in gloss not significant)

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ACCELERATED WEATHERING

Accelerated Weathering Capabilities

- Xenon, QUV, and new Super UV weather-o-meters
- Super UV can simulate 1 year South Florida in **2 days**
- Allows for rapid screening and formulation DOE to significantly reduce R&D development time

Exposure	Standard	Test time
South Florida	ASTM D1435	1 year
QUV	ASTM G154	1200 hours
Super UV	Custom	2 days

Total UV 1 year South Florida ~280 MJ

ESTANE®
(Aliphatic TPU)

OTHER
(Aliphatic TPU)



14 Days in Super UV

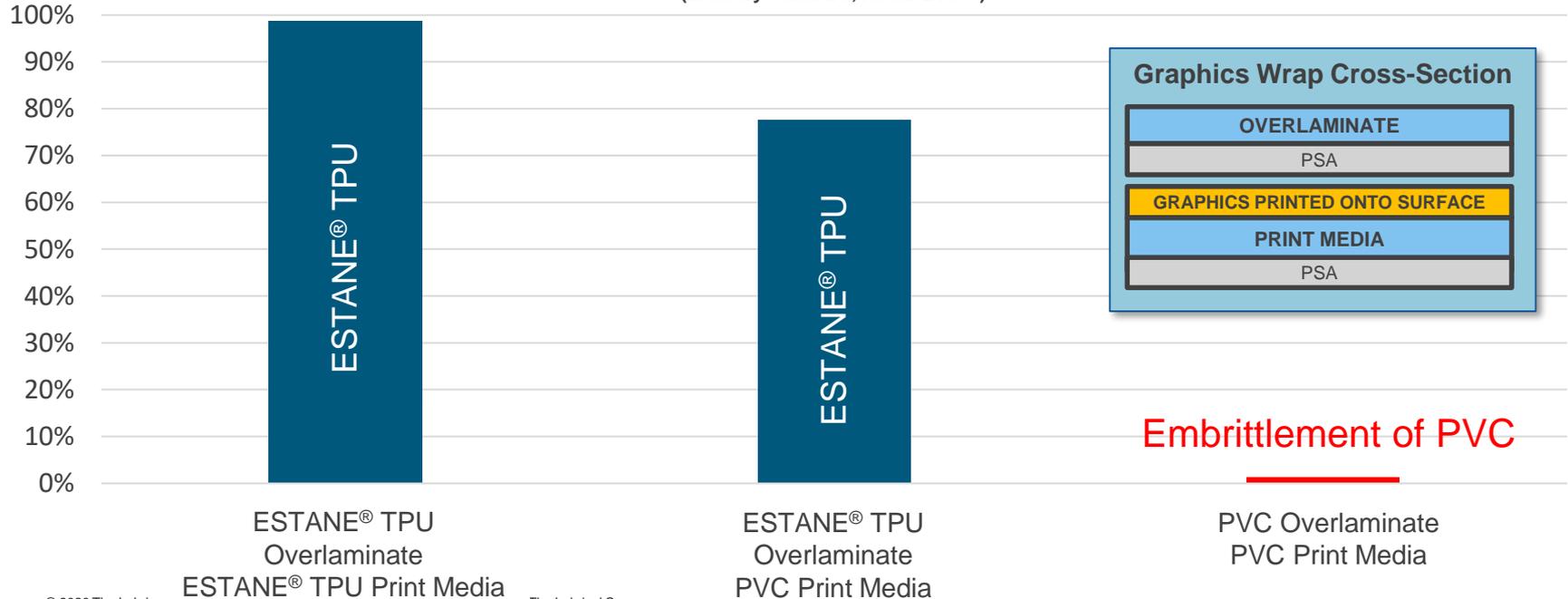


Super UV

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WEATHERING – GRAPHICS FILMS

% Elongation Retained After 2000 hrs Xenon UV Exposure
(Industry standard, ASTM D7869)

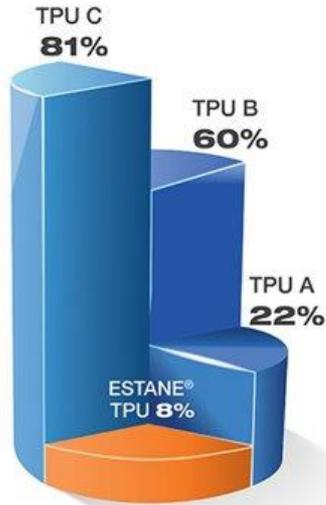


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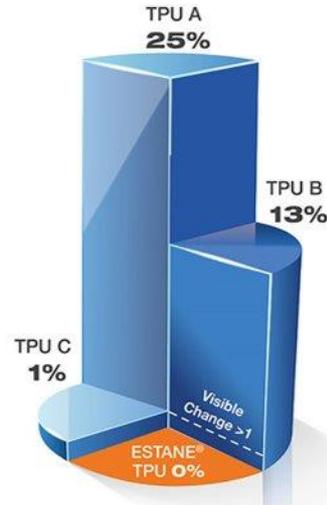
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ESTANE® TPU FOR PPF – CONSISTENT PERFORMANCE

ESTANE® TPU is the highest, most consistent performing TPU for PPF after **9 years** of equivalent weathering exposure.*



Loss of Tear Strength
(ASTM D470)



Change in Haze
(ASTM D1003)



Change in Yellowness Index
(ASTM D1925)

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*UV exposure through Eye Super UV

TPU IMPACT RESISTANCE

Painted metal panel impacted with and without protection from ESTANE® ALR Series TPU:



250-300 Stones @ 30-60 MPH
(*In accordance with SAE J400)



No Protection

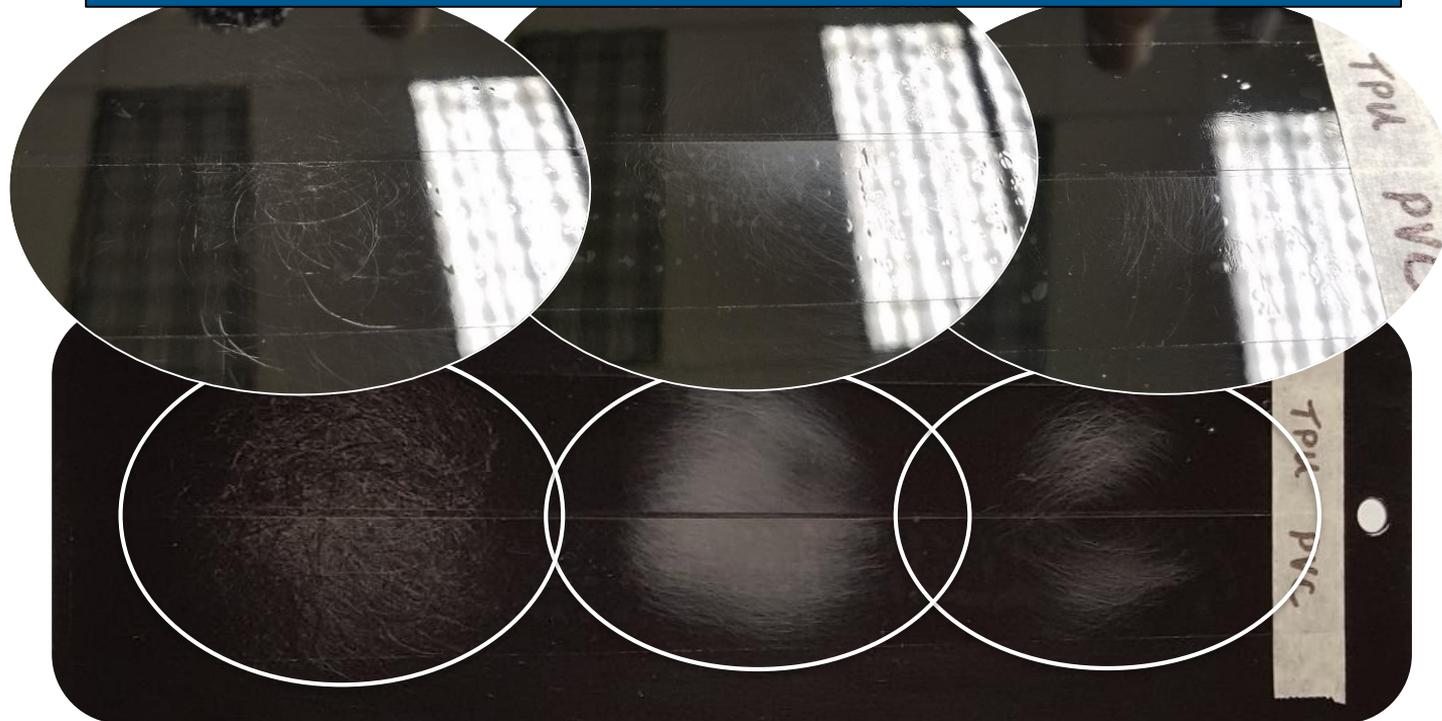


ESTANE® ALR Series TPU
(6 mil film)

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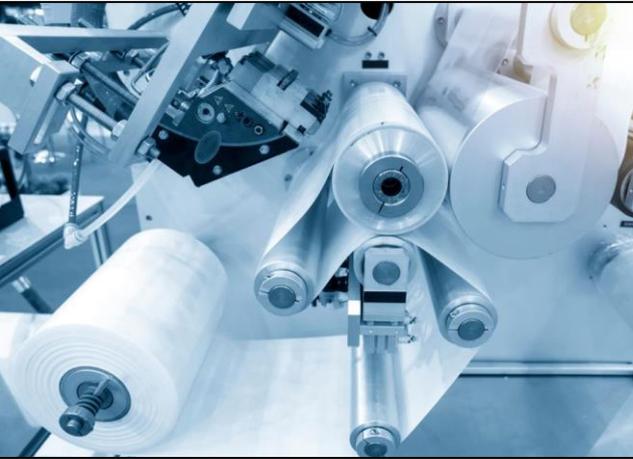
SELF-HEALING – ESTANE® TPU VERSUS PVC

After exposure to hot water for approximately 5 seconds



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OUR BROAD APPLICATION CAPABILITIES



EXTRUSION

- Cast or Blown Film
- Single or Multi Layer
- Capstock
- Interlayer Construction



MOLDING

- Compression Molding
- Injection Molding
- Overmolding



LAMINATION

- Heat Lamination
- Compatible with Film or Sheet

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DEDICATED APPLICATIONS EXPERTISE

- R&D staff with expertise processing TPU for major fabrication processes
- Rapid prototyping to **shorten development cycle**
- Development of custom applications and test methods



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MATERIAL SCIENCE EXPERTISE

- **Microscopy, X-Ray & Surface Science**
- **Spectroscopy** MS, NMR, IR & UV/VIS
- **Polymer Physics** DSC, DMA, TMA, TGA & Rheology
- **Chromatography** GC, GC/MS, IC, SFC, GPC, HPLC & LC/MS



- Polymer process simulation
- Inorganic & Wet Chemistry ICP, PC
- Physical & Mechanical Properties Testing



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SUMMARY



ESTANE® TPU – innovative solutions for a changing world...

- Proven history in demanding Surface Protection applications
 - Maintaining the beauty of surfaces
- Broad capabilities & extensive portfolio enables reach into new, adjacent applications
 - Achieving consumer expectations and sustainability
- Global organization aligned with local, regional support
 - Where you need us, when you need us
- Committed to being your partner – even in challenging times!

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From the invention of ESTANE® TPU through our newest innovations, we improve lives and deliver success by helping customers solve problems they once thought impossible. We bring together the people, ideas and technologies that can enable new designs, better performing products and more sustainable outcomes. We're proud to be part of The Lubrizol Corporation, a Berkshire Hathaway company. Lubrizol combines market insights, chemistry and application capabilities to deliver efficiency, reliability and wellness in global transportation, industrial and consumer markets.

To learn more, visit www.lubrizol.com

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