

**HUNTSMAN**

Enriching lives through innovation

# Delivering peace of mind

TPU films for Safety  
Glazing applications





# Experts in elastomers

Our polyurethanes business division is a leading developer of polyurethane (PU) and thermoplastic polyurethane (TPU) materials. Combining global reach with decades of experience in material innovation, we are experts in urethane-based elastomers and have in-depth knowledge of their application across a vast range of industries.

## A reliable partner for safety glazing producers

We are the developer and manufacturer of KRYSTALFLEX® TPU films, based on aliphatic elastomers, which are well known for their performance in safety glazing applications. Helping to set the standard for interlayer laminating films, our KRYSTALFLEX® TPU films are trusted to create impact resistant laminated glass that is tough enough for use in extreme environments.

### Typical applications:

- Aerospace
- High-speed rail
- Military vehicles
- Antiballistic glazing
- Building security.

### Film properties:

- Low temperature impact resistance
- Excellent adhesion to glass, polycarbonate (PC) and polymethylmethacrylate (PMMA)
- Moisture resistance
- Low lamination temperature compatible with PMMA
- Lamination possible, even with complex surfaces with double degree of curvature.

Our KRYSTALFLEX® TPU films are available in a variety of thicknesses (0.38 to 1.27 mm) and roll widths (0.6 to 2.0 m) - meaning we can find a solution to best suit your glazing application. We also offer a range of KRYSTALFLEX® PE 900 TPU edge seals available in widths ranging from 10 to 140 mm.



# Infinite scope for innovation

## KRYSTALFLEX® TPU films: Key products

TYPICAL PROPERTIES			BASE PRODUCTS		SPECIALTY PRODUCTS		
	Unit	Test method	KRYSTALFLEX® PE 399	KRYSTALFLEX® PE 499	KRYSTALFLEX® PE 429	KRYSTALFLEX® PE 501	
<b>GENERAL</b>							
Hardness	Shore A	ASTM D-2240 DIN 53505	76	61	61	94	
Hardness	Shore D	ASTM D-2240 DIN 53505	34	15	18	53	
Specific gravity	g/cm³	ASTM D-792	1,07	1,07	1,04	1,07	
<b>MECHANICAL</b>							
Tensile strength	MPa	DIN 53504	36	15	27	51	
	psi	ASTM D-412	5280	2230	3970	7350	
Tensile stress @ 100% elongation	MPa	DIN 53504	3	2	3	9	
	psi	ASTM D-412	460	310	390	1350	
Tensile stress @ 300% elongation	MPa	DIN 53504	11	4	6	31	
	psi	ASTM D-412	1600	530	880	4450	
Elongation @ break	%	DIN 53504 ASTM D-412	440	660	590	380	
Tear strength	N/mm	DIN 53515	42	39	47	79	
	pli	ASTM D-624	240	220	270	450	
<b>PEEL RESISTANCE TO GLASS</b>							
Lamination temperature (°C)	85 °C	N/mm	ASTM D-3167	3	14	14	n/a
	91 °C			12	18	24	9
	99 °C			25	24	24	22
	113 °C			25	n/a	n/a	26
	118 °C			25	n/a	n/a	27
	127 °C			25	n/a	n/a	n/a
Lamination temperature (°F)	185 °F	pli	ASTM D-3167	16	80	80	n/a
	195 °F			67	105	138	53
	210 °F			140	135	138	125
	235 °F			140	n/a	n/a	146
	245 °F			140	n/a	n/a	155
	260 °F			140	n/a	n/a	n/a
<b>THERMAL</b>							
TMA melt range low	°C	Huntsman	90	78	83	89	
	°F	Huntsman	194	172	181	192	
TMA melt range high	°C	Huntsman	136	116	130	127	
	°F	Huntsman	277	241	266	261	
<b>GLASS TRANSITION TEMPERATURE</b>							
Tg (DMA)	°C	ASTM D-5026	-50	-52	-62	-58	
	°F	ASTM D-5026	-58	-62	-80	-72	

You can find further information about the complete range of film and sheet elastomers that we offer in our dedicated film and sheet brochure. Further technical data about individual products, along with best practice advice for handling and processing our TPU films, is available from our local sales representative or by visiting our online product finder tool:

<http://www.huntsman-tpu.com/>



# Global elastomers experts

**Committed to customers:** We build partnerships with our customers and work across an international network of R&D and manufacturing locations to help solve complex challenges and deliver the highest levels of technical support and customer care.

**Committed to quality:** Wherever we are, whatever we are doing, we prioritize environmental, health and safety protection, and we are always rigorous about quality control and assurance.

**Committed to innovation:** We keep pace with the most innovative trends in plastics processing by using the latest equipment and making regular investments in our formulation, manufacturing and R&D capabilities.

**Committed to sustainability:** We create solutions that contribute to a more sustainable society by helping to conserve energy, preserve natural resources and reduce our overall carbon footprint.



## HUNTSMAN

Enriching lives through innovation

### EUROPE

Everslaan 45  
3078 EVERBERG  
BELGIUM  
Phone: +32 2 758 92 11  
Elastomers\_EAIME@huntsman.com

### USA

10003 Woodloch Forest Dr  
The Woodlands, TX 77380  
Phone: +1 281 719 6000  
Elastomers\_Americas@huntsman.com

### CHINA

No 479 Wen Jing Road  
Minhang Development Zone  
Shanghai 200245  
Phone: +86 21 3357 6527  
Elastomers\_APAC@huntsman.com

[www.huntsman.com](http://www.huntsman.com)

### About Huntsman:

Huntsman Corporation is a publicly traded global manufacturer and marketer of differentiated and specialty chemicals with 2018 revenues of more than \$9 billion. Our chemical products number in the thousands and are sold worldwide to manufacturers serving a broad and diverse range of consumer and industrial end markets. We operate more than 75 manufacturing, R&D and operations facilities in approximately 30 countries and employ approximately 10,000 associates within our four distinct business divisions.

Huntsman Corporation warrants only that its products meet the specifications stated in the sales contract. Typical properties, where stated, are to be considered as representative of current production and should not be treated as specifications. While all the information presented in this document is believed to be reliable and to represent the best available data on these products, HUNTSMAN MAKES NO WARRANTY OR GUARANTEE OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, NON-INFRINGEMENT OF ANY INTELLECTUAL PROPERTY RIGHT OF ANY THIRD PARTY, OR WARRANTIES AS TO QUALITY OR CORRESPONDENCE WITH PRIOR DESCRIPTION OR SAMPLE, AND ANY USER OF PRODUCTS DESCRIBED HEREIN SHOULD CONDUCT A SUFFICIENT INVESTIGATION TO ESTABLISH THE SUITABILITY OF ANY PRODUCT FOR ITS INTENDED USE AND ASSUMES ALL RISK AND LIABILITY WHATSOEVER RESULTING FROM THE USE OF SUCH PRODUCT, WHETHER USED SINGLY OR IN COMBINATION WITH OTHER SUBSTANCES. Products may be toxic and require special precautions in handling. For all products described herein, the user should obtain detailed information on toxicity, together with proper shipping, handling, and storage procedures, and should comply with all applicable safety and environmental standards. The behavior, hazards and/or toxicity of the products referred to in this publication in manufacturing processes and their suitability in any given end-use environment are dependent upon various conditions such as chemical compatibility, temperature, and other variables, which may not be known to Huntsman. It is the sole responsibility of the user of such products to evaluate the manufacturing circumstances and the final products under actual end-use requirements and to adequately advise and warn future purchasers and users thereof.

KRYSTALFLEX® is a registered trademark of Huntsman Corporation or an affiliate thereof in one or more, but not all, countries. Copyright © 2019 Huntsman Corporation or an affiliate thereof. All rights reserved.